

**NASA  
Reference  
Publication  
1084**

December 1981

# Atlas of Absorption Lines From 0 to 17 900 $\text{cm}^{-1}$

Jae H. Park,  
L. S. Rothman,  
C. P. Rinsland,  
M. A. H. Smith,  
D. J. Richardson,  
and J. C. Larsen

LOAN COPY: RETURN TO  
AFWL TECHNICAL LIBRARY  
KIRTLAND AFB, N. M.

NASA  
RP  
1084  
c.1



**NASA**

**NASA  
Reference  
Publication  
1084**

1981

TECH LIBRARY KAFB, NM



0063238

# Atlas of Absorption Lines From 0 to 17 900 cm<sup>-1</sup>

Jae H. Park,  
*NASA Langley Research Center  
Hampton, Virginia*

L. S. Rothman  
*Air Force Geophysics Laboratory  
Hanscom AFB, Massachusetts*

C. P. Rinsland  
*College of William and Mary  
Williamsburg, Virginia*

M. A. H. Smith  
*NASA Langley Research Center  
Hampton, Virginia*

D. J. Richardson and J. C. Larsen  
*Systems and Applied Sciences Corporation  
Hampton, Virginia*



National Aeronautics  
and Space Administration

Scientific and Technical  
Information Branch



# DESCRIPTION OF THE ATLAS

This atlas is a pictorial representation of atmospheric absorption line parameters contained in the AFGL (Air Force Geophysics Laboratory) major-gas and trace-gas compilations currently available on magnetic tape (Rothman 1981, Rothman et al. 1981). It is a revised edition of the atlas previously published by Park (1977), which had been based on an earlier version of the AFGL major-gas compilation (McClatchey et al. 1973) and trace-gas line parameters collected at NASA Langley Research Center. This earlier publication has become very useful as a quick reference for researchers in the fields of molecular spectroscopy and atmospheric remote sensing. Since new, extensively revised versions of the AFGL line parameter compilations have recently been released, the authors felt that a new edition of the atlas was necessary.

In the atlas are presented plots of the logarithm (base 10) of absorption line strength ( $S$  in  $\text{atm}^{-1}\text{-cm}^{-2}$ ) at 296 K versus wavenumber (in  $\text{cm}^{-1}$ ) for atmospheric gases (see table I). The atlas covers the spectral range of the AFGL compilations

TABLE I.- LIST OF GASES SHOWN  
IN THE ATLAS

AFGL Gas Code	Gas name
1	H <sub>2</sub> O
2	CO <sub>2</sub>
3	O <sub>3</sub>
4	N <sub>2</sub> O
5	CO
6	CH <sub>4</sub>
7	O <sub>2</sub>
8	NO
9	SO <sub>2</sub>
10	NO <sub>2</sub>
11	NH <sub>3</sub>
12	HNO <sub>3</sub>
13	OH
14	HF
15	HCl
16	HBr
17	HI
18	ClO
19	OCS
20	H <sub>2</sub> CO
(a)	N <sub>2</sub>
(a)	CH <sub>3</sub> Cl
(a)	Solar CO

<sup>a</sup>Indicates data not in 1980 AFGL compilations. O<sub>2</sub> quadrupole lines near 6.3  $\mu\text{m}$  are also not included in the 1980 major-gas tape.



(0 to 17 900  $\text{cm}^{-1}$ ). Line parameters for all gases are taken from the 1980 versions of the AFGL major-gas and trace-gas compilations, and additional data are included for the electric quadrupole lines of  $\text{O}_2$  (Rothman and Goldman 1981) and of  $\text{N}_2$  (obtained from S. P. Reddy, Memorial University of Newfoundland, 1981) and for the  $\nu_4$  band of  $\text{CH}_3\text{Cl}$  (Margolis 1978). Solar CO lines at 6000 K, calculated by C. P. Rinsland in 1981, are also shown for the fundamental and first overtone sequences. The solar CO line strengths were calculated with the dipole moment function of Kirschner et al. (1977) following Tipping (1976) with terrestrial isotope ratios assumed. All isotopic bands contained in the AFGL compilation are included in this atlas, as well as the  $\nu_4$  bands of both  $\text{CH}_3\text{Cl}^{35}$  and  $\text{CH}_3\text{Cl}^{37}$  and the main isotopes of  $\text{O}_2$  and  $\text{N}_2$  for the quadrupole transitions. As in the AFGL compilation, intensities of all bands are scaled according to the terrestrial abundance of each isotopic species.

On each page of the atlas, the plots of  $\log(S)$  versus wavenumber for all gases having absorption lines in the same 50  $\text{cm}^{-1}$  interval are presented in order of the integer gas codes given in table I. For the major gases ( $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ,  $\text{O}_3$ ,  $\text{N}_2\text{O}$ ,  $\text{CO}$ ,  $\text{CH}_4$ , and  $\text{O}_2$ ), all lines having strengths within  $10^{-6}$  of the maximum value for that interval are shown; and for the trace gases, all lines having strengths within  $10^{-4}$  of the maximum are included. Because the maximum and minimum line strengths are redetermined for each 50  $\text{cm}^{-1}$  interval, sudden changes may appear in the line strength scale from one plot to another, and some weak lines on the AFGL tape are not plotted in this atlas. Isolated weak bands may also appear, at first glance, to be much stronger than expected. Since the number of gases appearing simultaneously in any single 50  $\text{cm}^{-1}$  interval is significantly reduced at wavenumbers higher than 5000  $\text{cm}^{-1}$ , plots of  $\log(S)$  versus wavenumber for two consecutive intervals are presented on the same page from 5000 to 10 000  $\text{cm}^{-1}$ , and three consecutive intervals are plotted together from 10 000 to 17 900  $\text{cm}^{-1}$ .

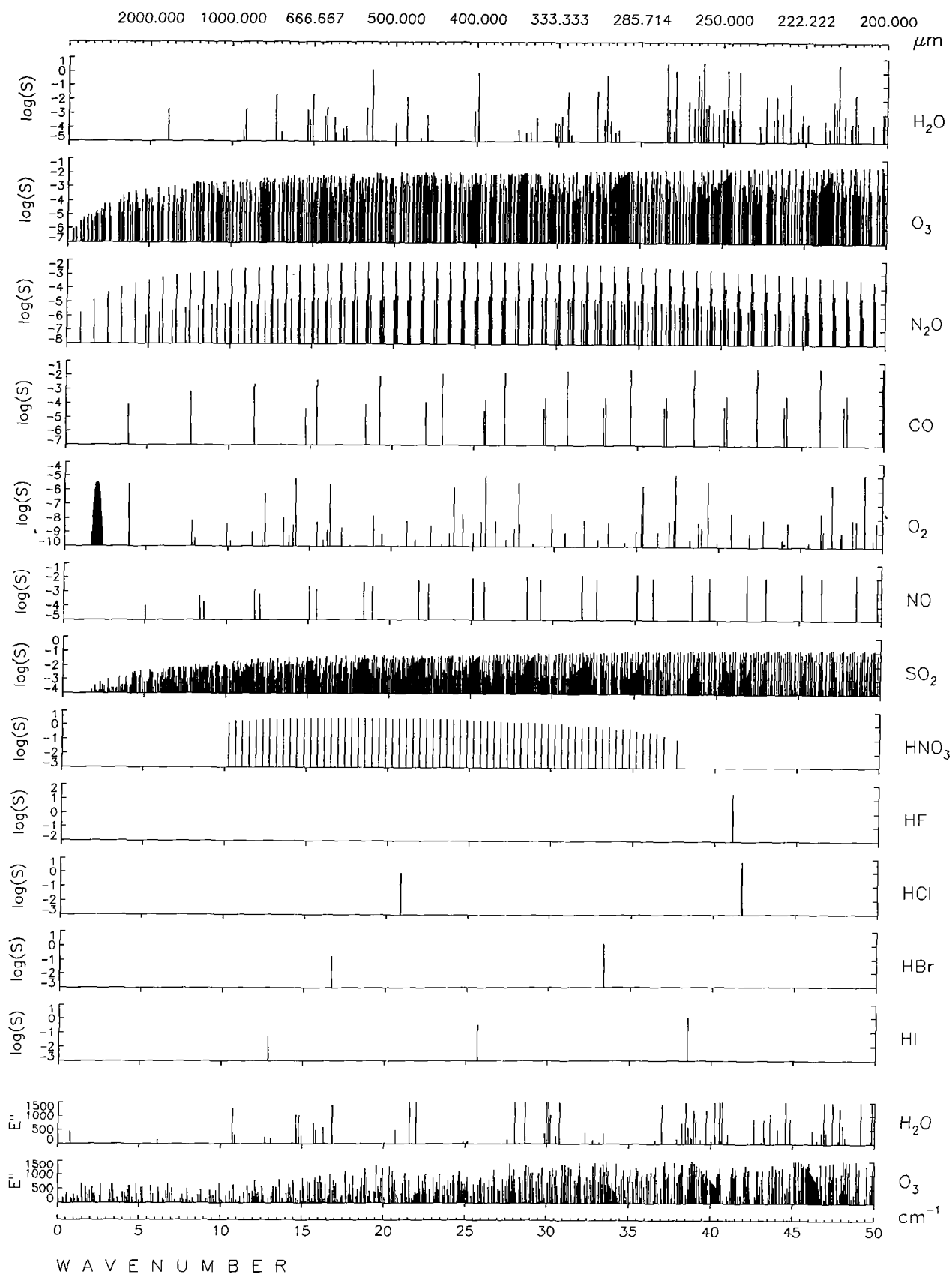
At the bottom of each page for intervals from 0 to 5000  $\text{cm}^{-1}$ , also presented are plots of the lower-state energy values ( $E''$  in  $\text{cm}^{-1}$ ) for lines of the strongly absorbing gases  $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ,  $\text{O}_3$ , and  $\text{CH}_4$ . These energy values are plotted as an aid to quickly judge the strength of atmospheric absorption by these gases at temperatures different from 296 K. Energy values greater than 1500  $\text{cm}^{-1}$  are plotted as 1500  $\text{cm}^{-1}$ ; in the few cases of unassigned transitions, where the energies are given as -1 on the AFGL tape, they are plotted as 0  $\text{cm}^{-1}$  in the atlas. At wavenumbers higher than 5000  $\text{cm}^{-1}$ , plots of  $E''$  versus wavenumber are omitted.

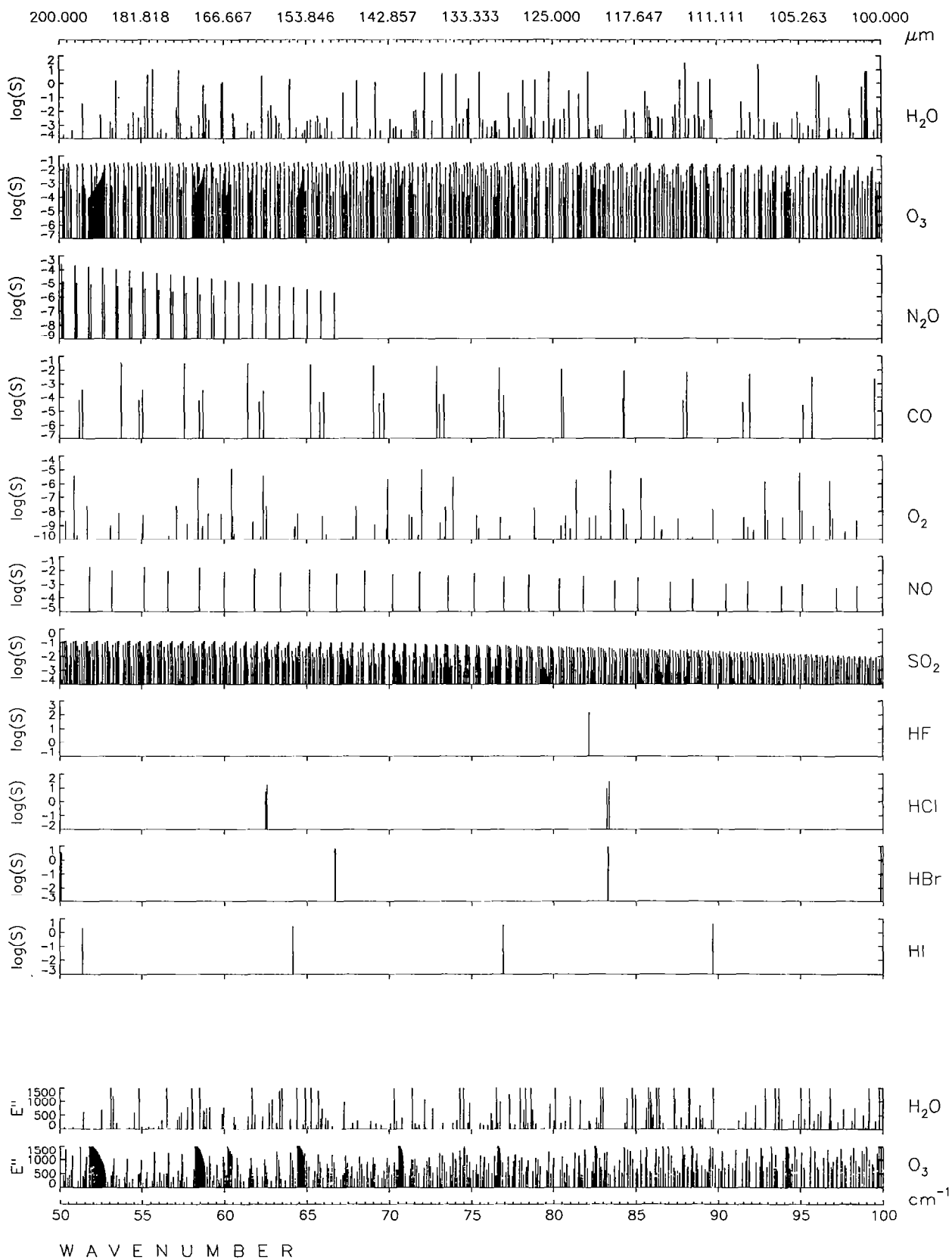
Updated versions of this atlas are planned when major revisions of the AFGL line parameter compilations are released.

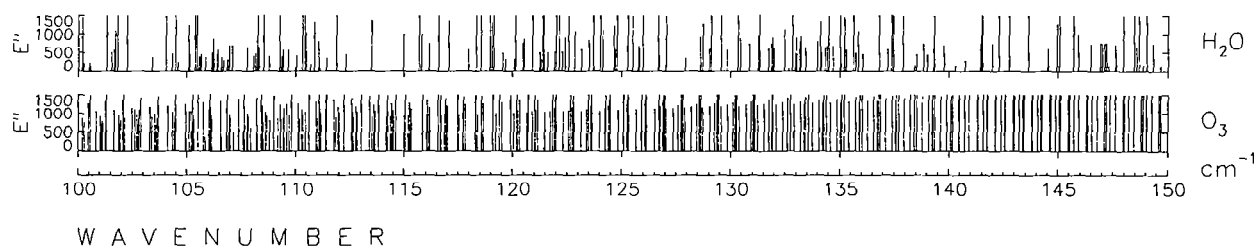
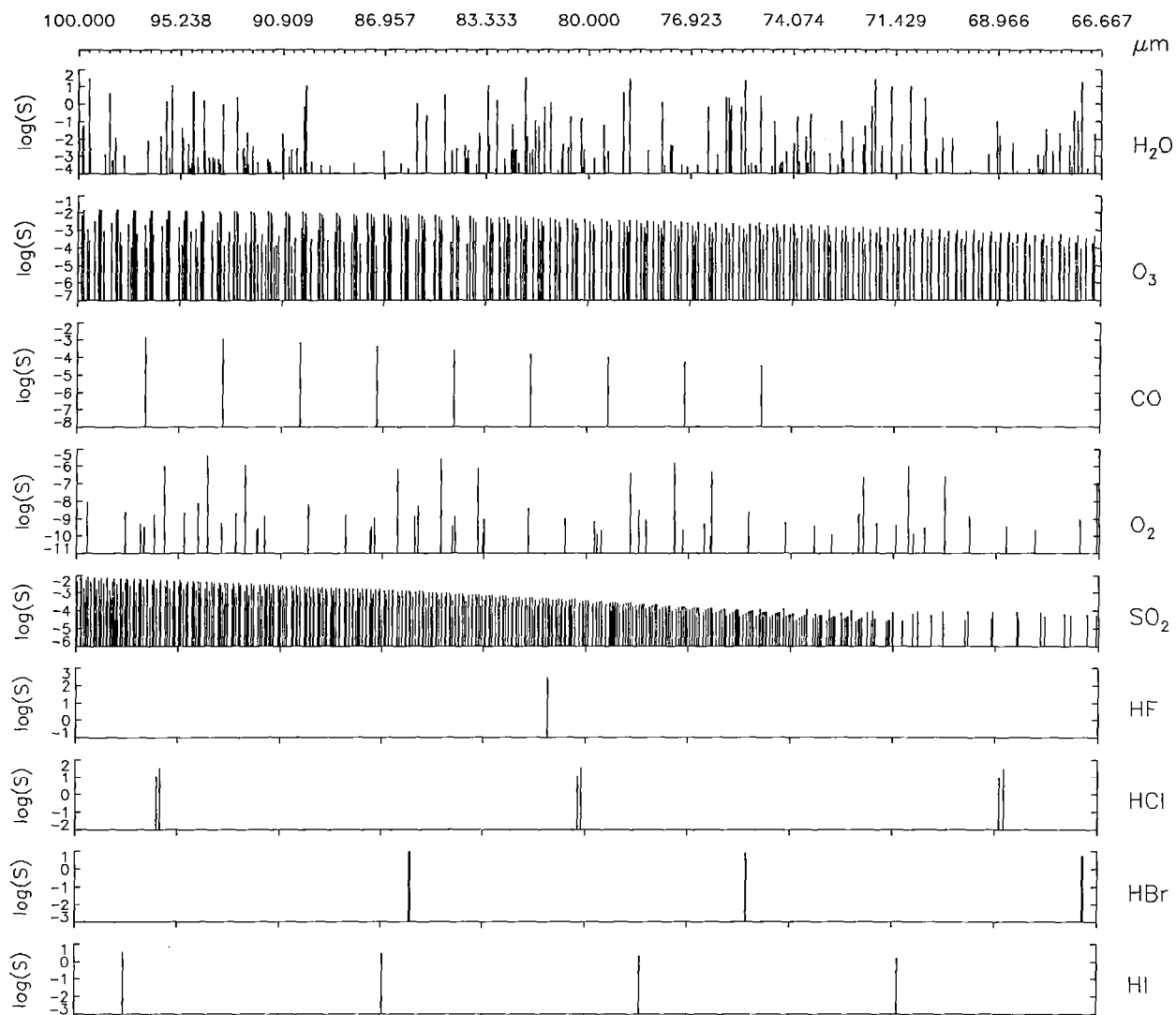
Langley Research Center  
National Aeronautics and Space Administration  
Hampton, VA 23665  
October 9, 1981

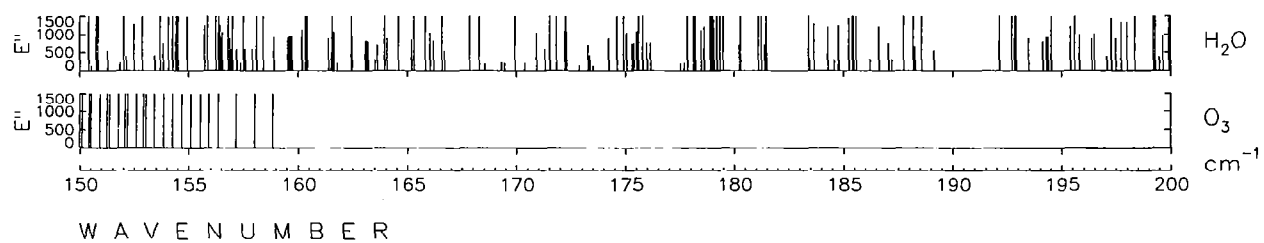
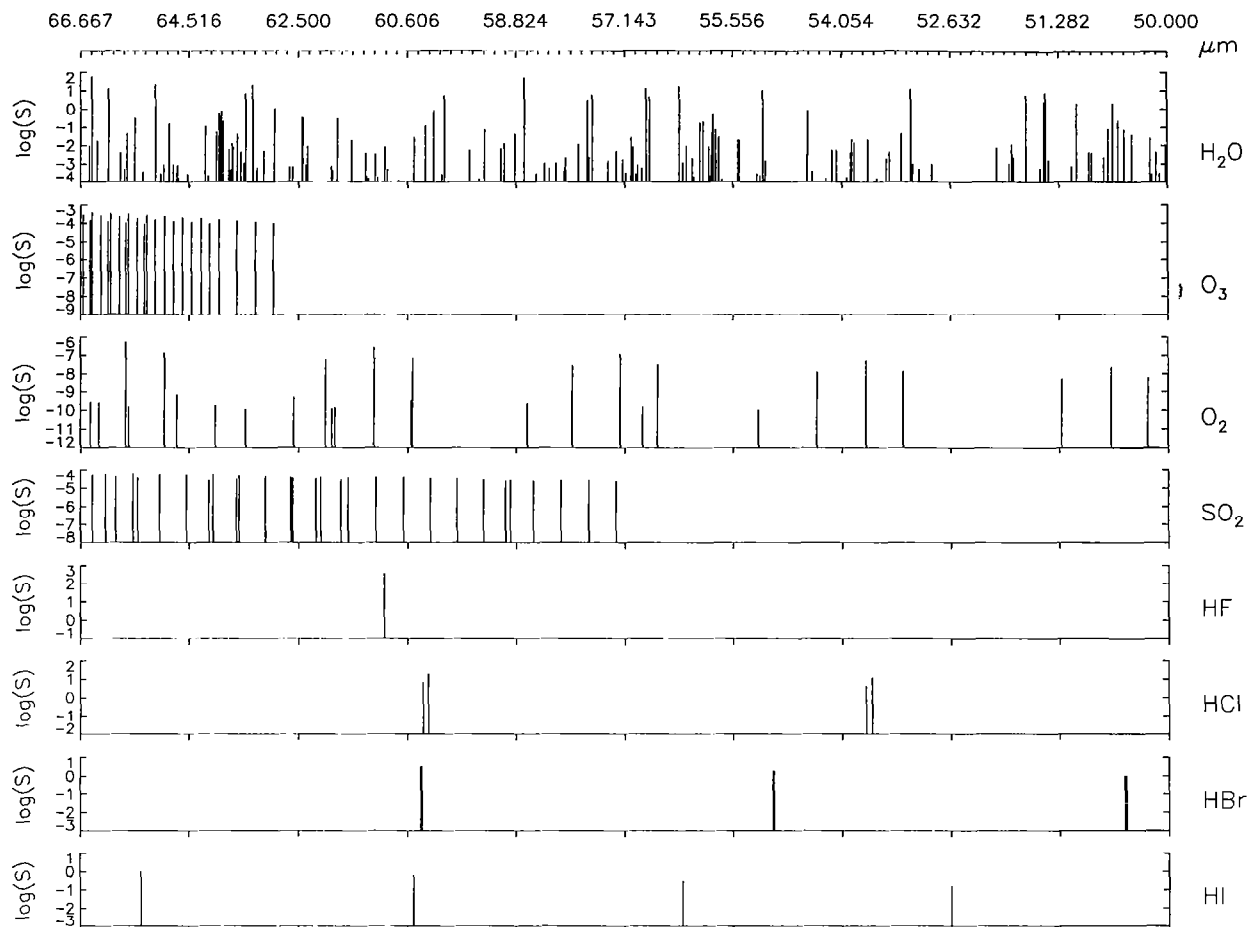
## REFERENCES

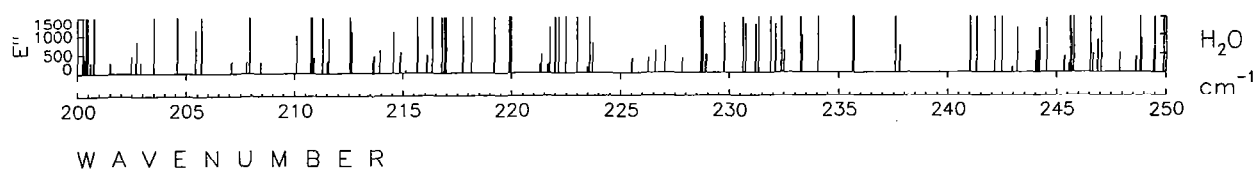
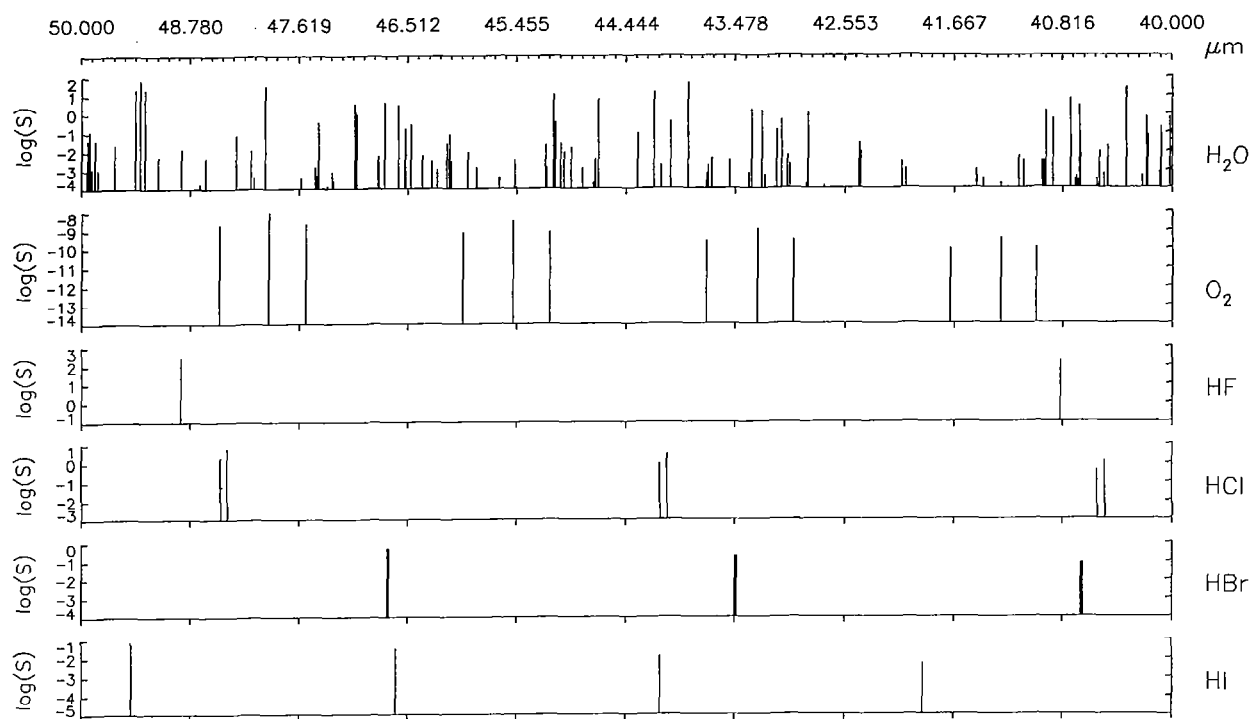
- Kirschner, Sidney M.; LeRoy, Robert J.; Ogilvie, John F.; and Tipping, Richard H. 1977: Radial Matrix Elements and Dipole Moment Function for the Ground State of CO. J. Mol. Spectros., vol. 65, no. 2, pp. 306-312.
- Margolis, Jack S. 1978: Absorption Strength of the Perturbed  $\nu_4$  Band of  $\text{CH}_3\text{Cl}$ . J. Mol. Spectros., vol. 70, no. 2, pp. 257-262.
- McClatchey, R. A.; Benedict, W. S.; Clough, S. A.; Burch, D. E.; Calfee, R. F.; Fox, K.; Rothman, L. S.; and Garing, J. S. 1973: AFCRL Atmospheric Absorption Line Parameters Compilation. AFCRL-TR-73-0096, U.S. Air Force. (Available from DTIC as AD 762 904.)
- Park, Jae H. 1977: Atlas of Infrared Absorption Lines. NASA CR-2925.
- Rothman, L. S. 1981: AFGL Atmospheric Absorption Line Parameters Compilation: 1980 Version. Appl. Opt., vol. 20, no. 5, pp. 791-795.
- Rothman, L. S.; Goldman, A.; Gillis, J. R.; Tipping, R. H.; Brown, L. R.; Margolis, J. S.; Maki, A. G.; and Young, L. D. G. 1981: AFGL Trace Gas Compilation: 1980 Version. Appl. Opt., vol. 20, no. 8, pp. 1323-1328.
- Rothman, L. S.; and Goldman, A. 1981: Infrared Electric Quadrupole Transitions of Atmospheric Oxygen. Appl. Opt., vol. 20, no. 13, pp. 2182-2184.
- Tipping, R. H. 1976: Vibration-Rotation Intensities for "Hot" Bands. J. Mol. Spectros., vol. 61, no. 2, pp. 272-281.

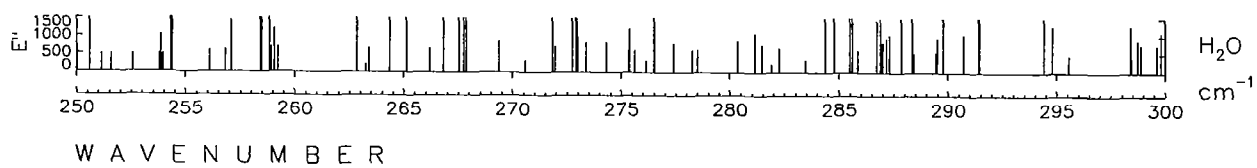
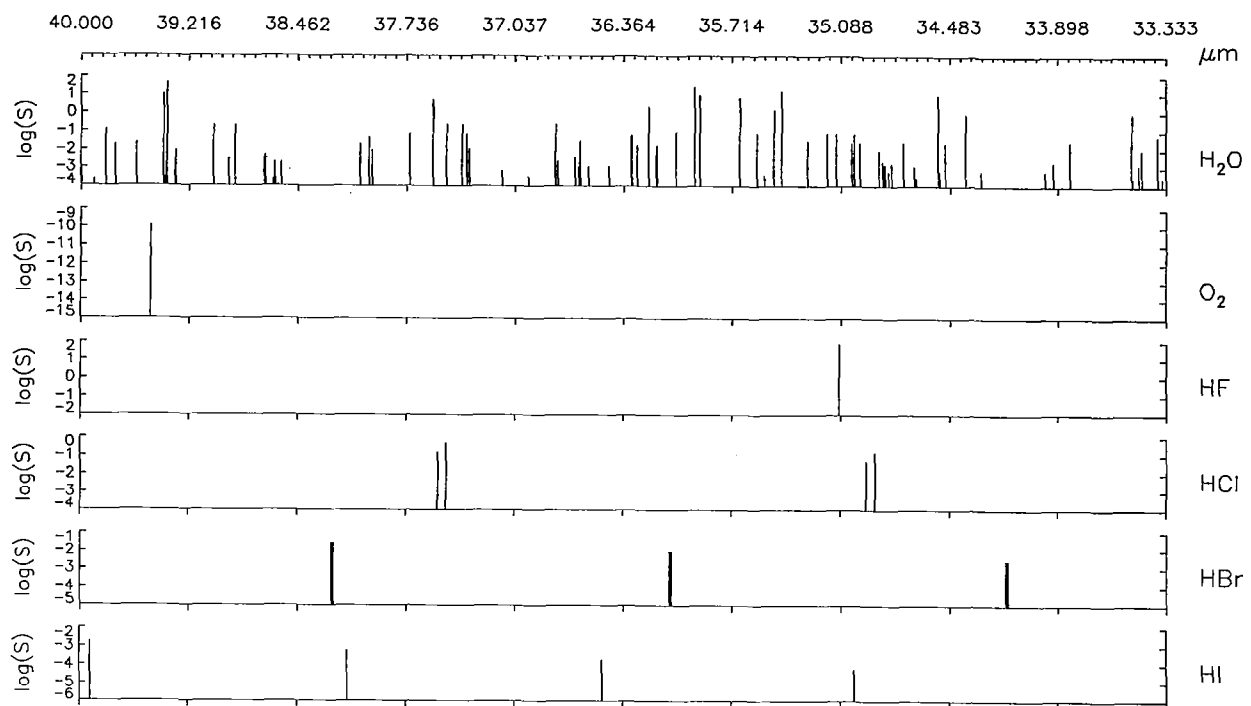




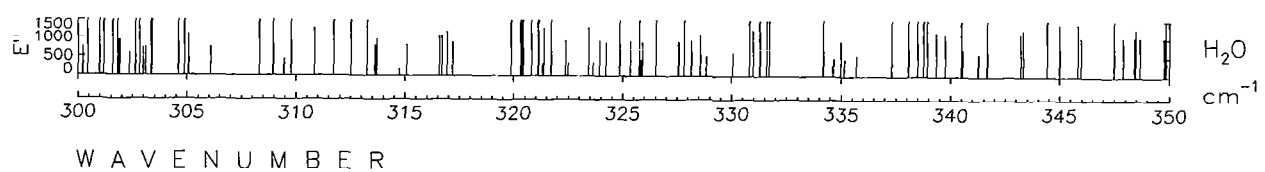
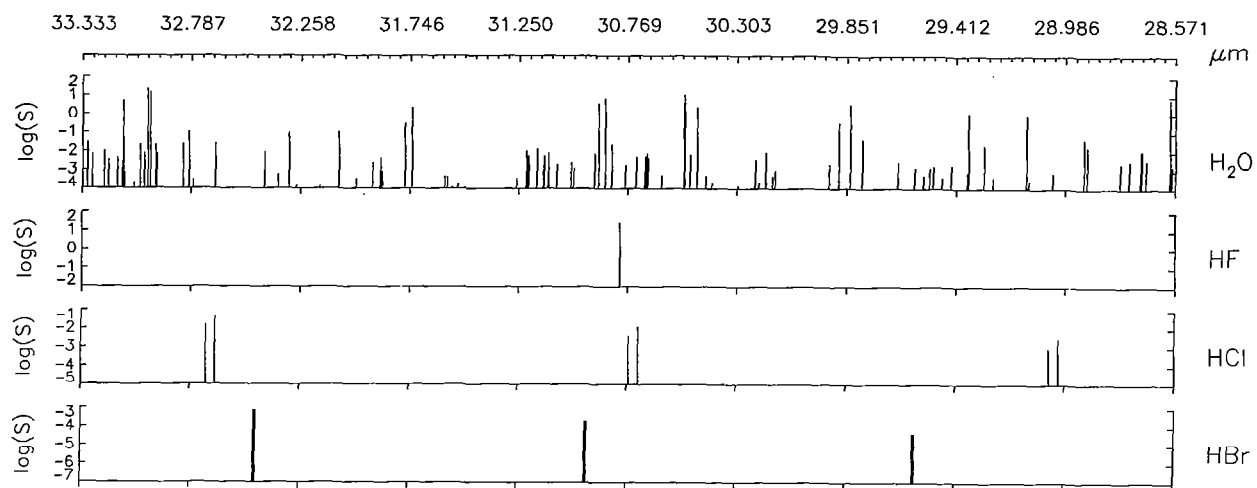


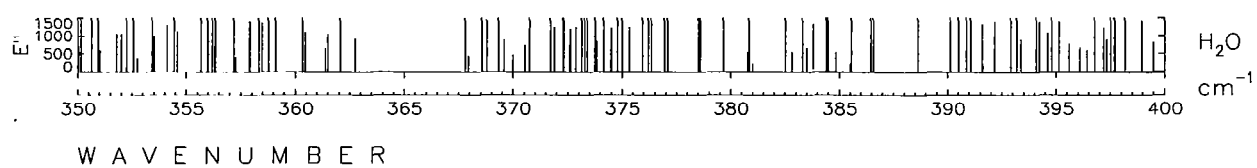
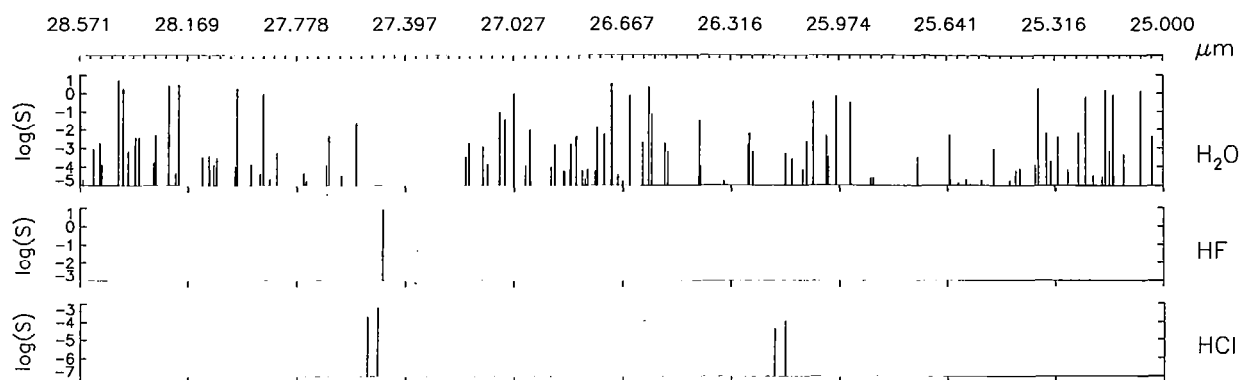


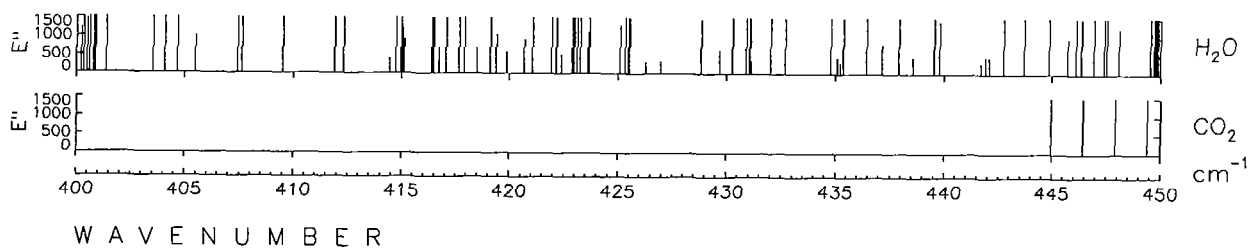
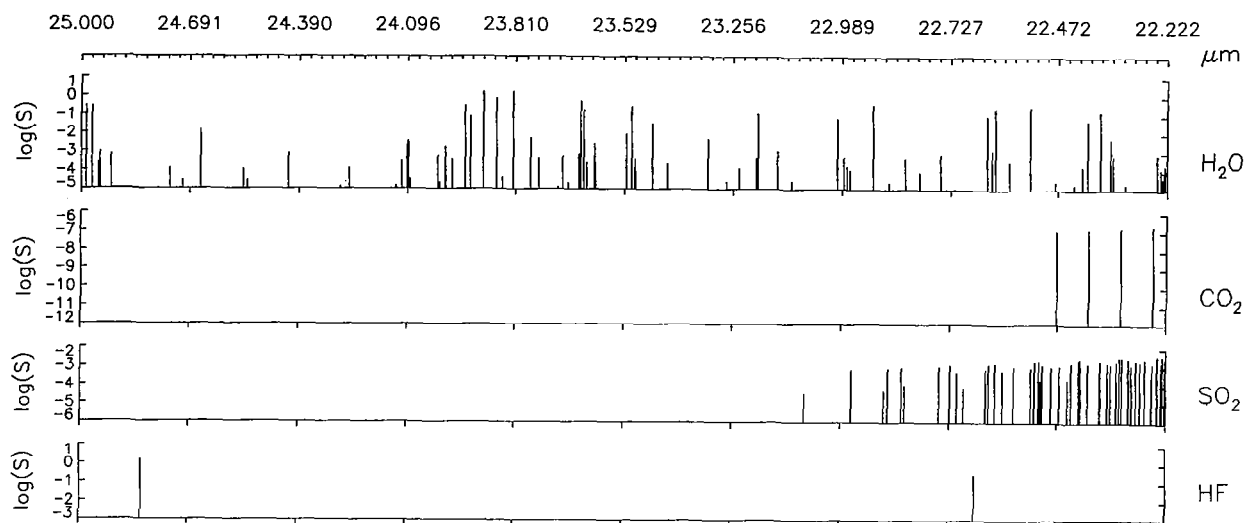


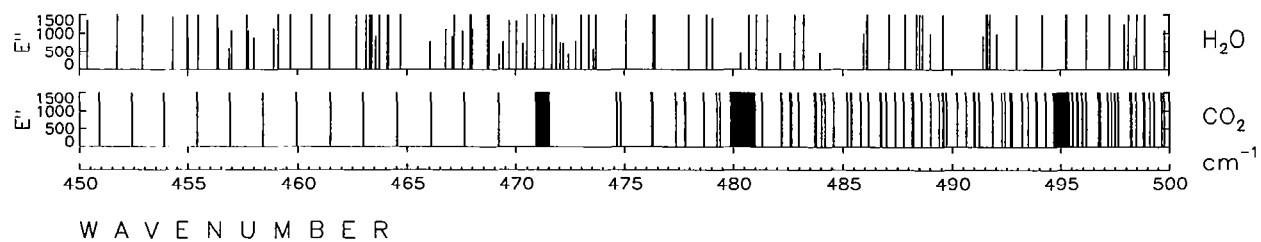
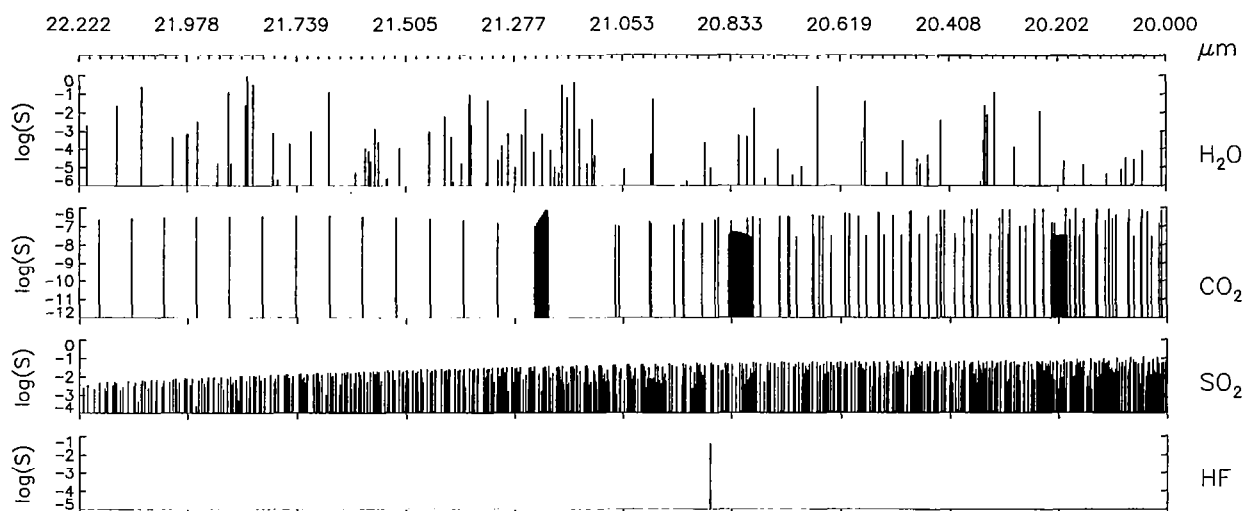


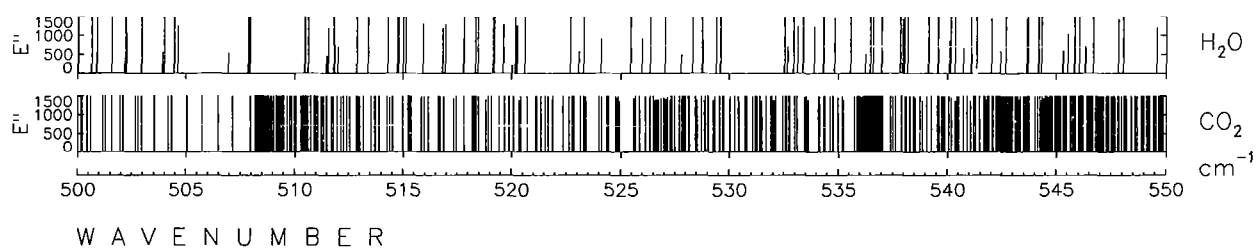
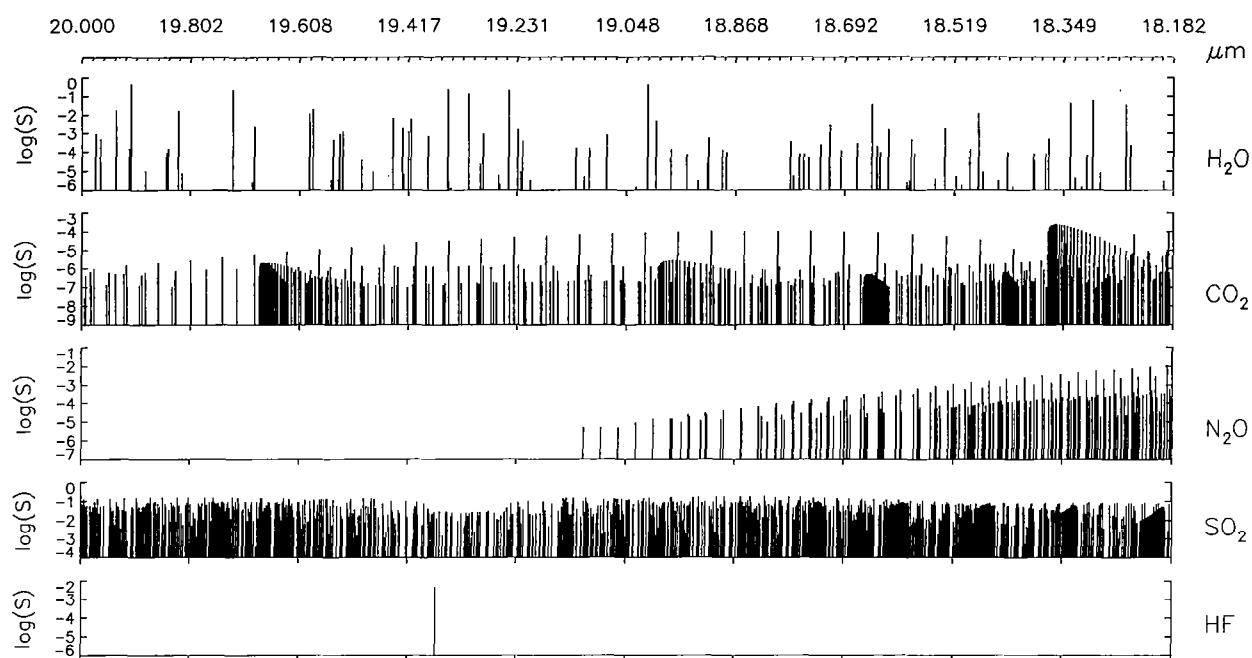


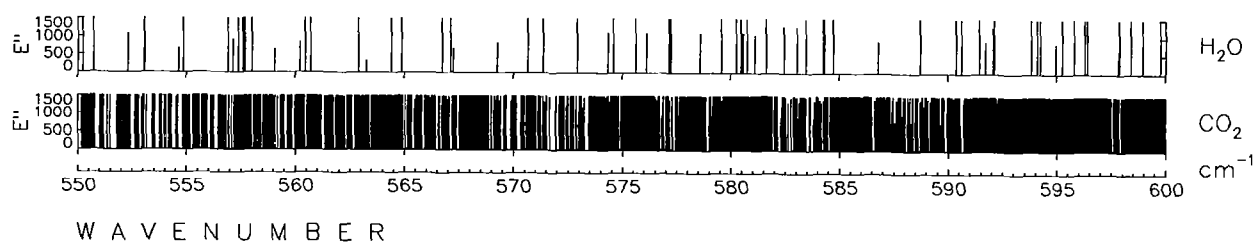
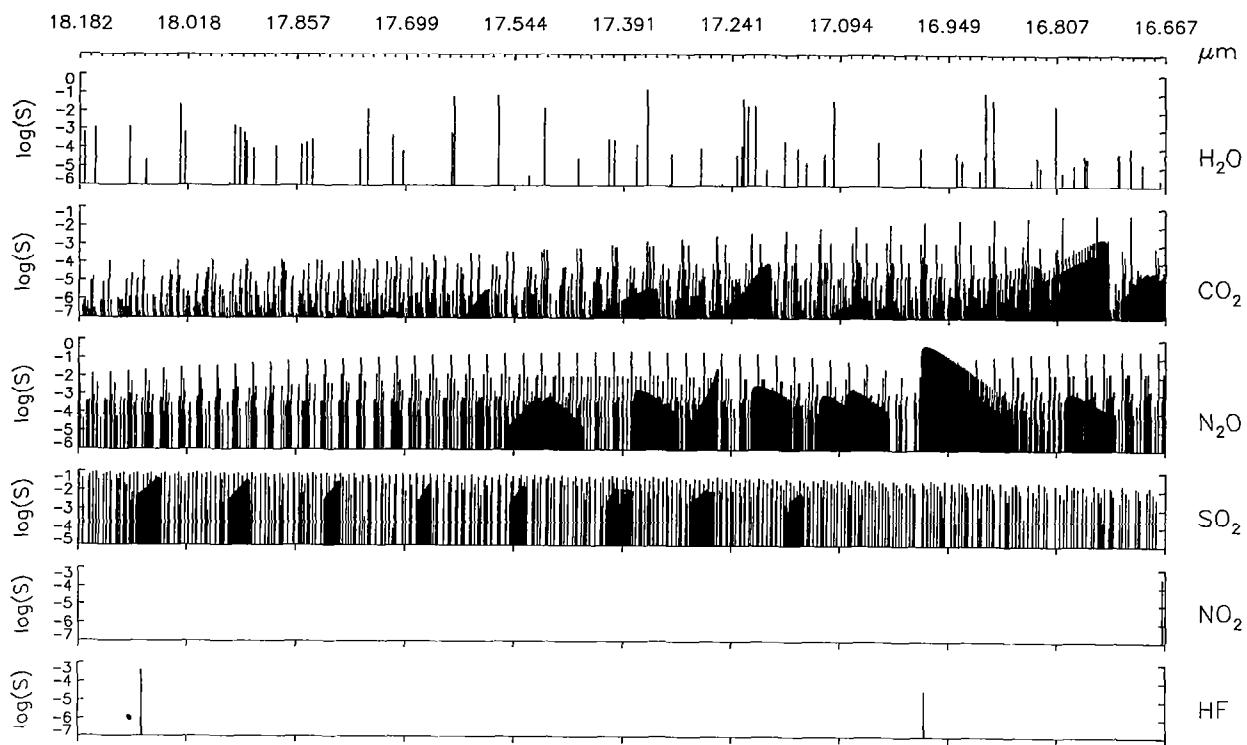


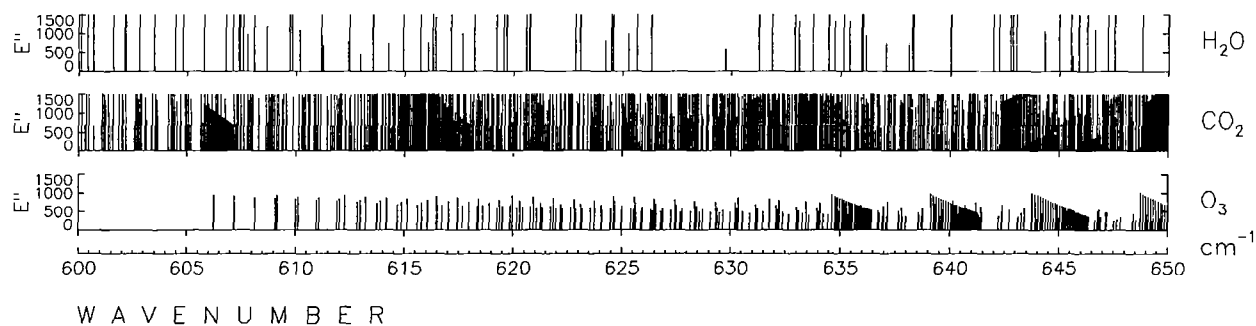
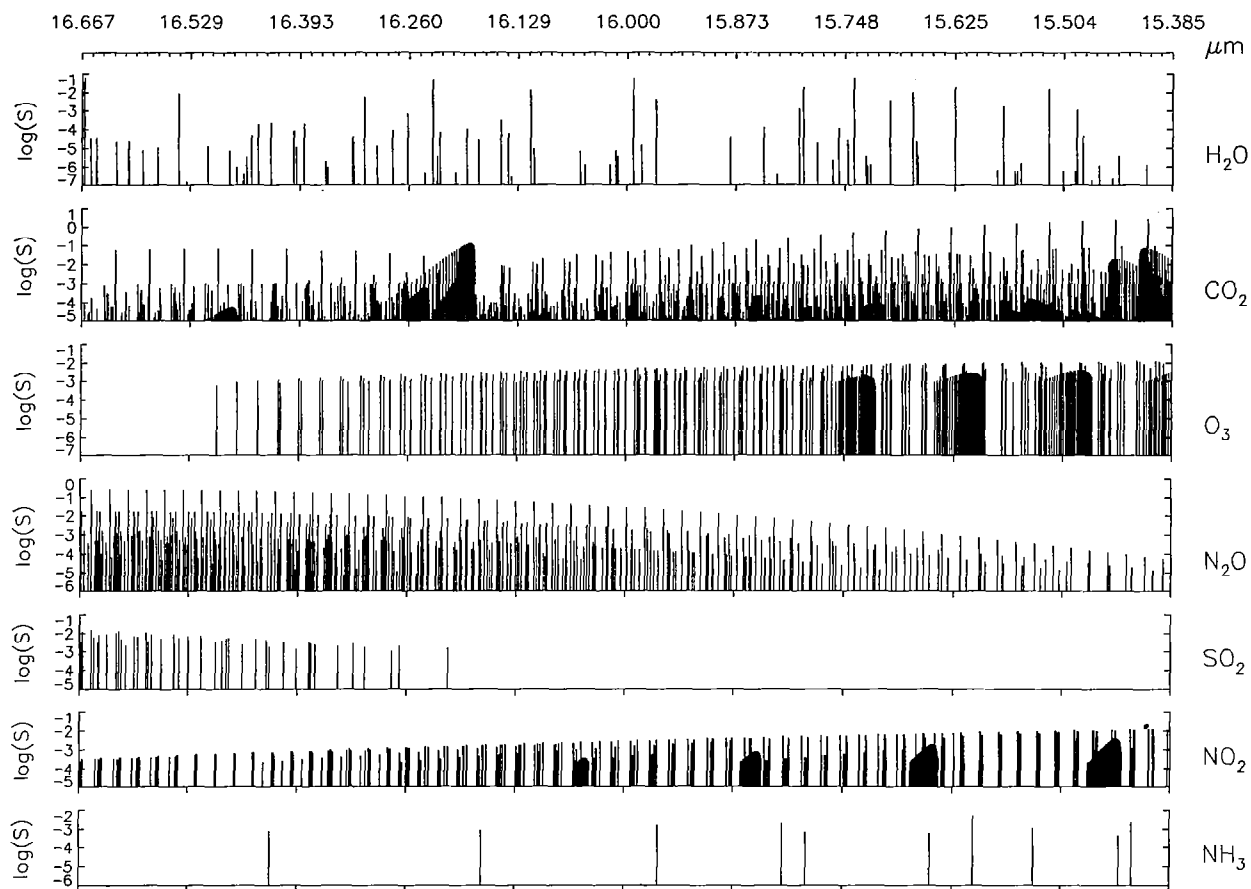


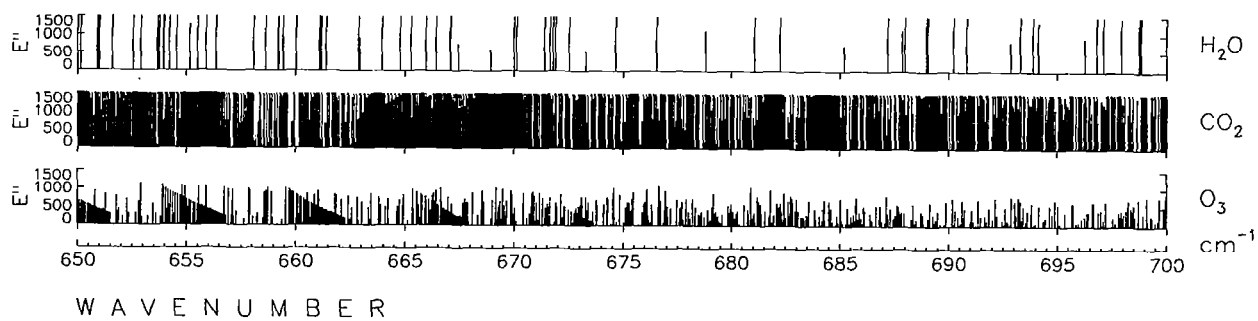
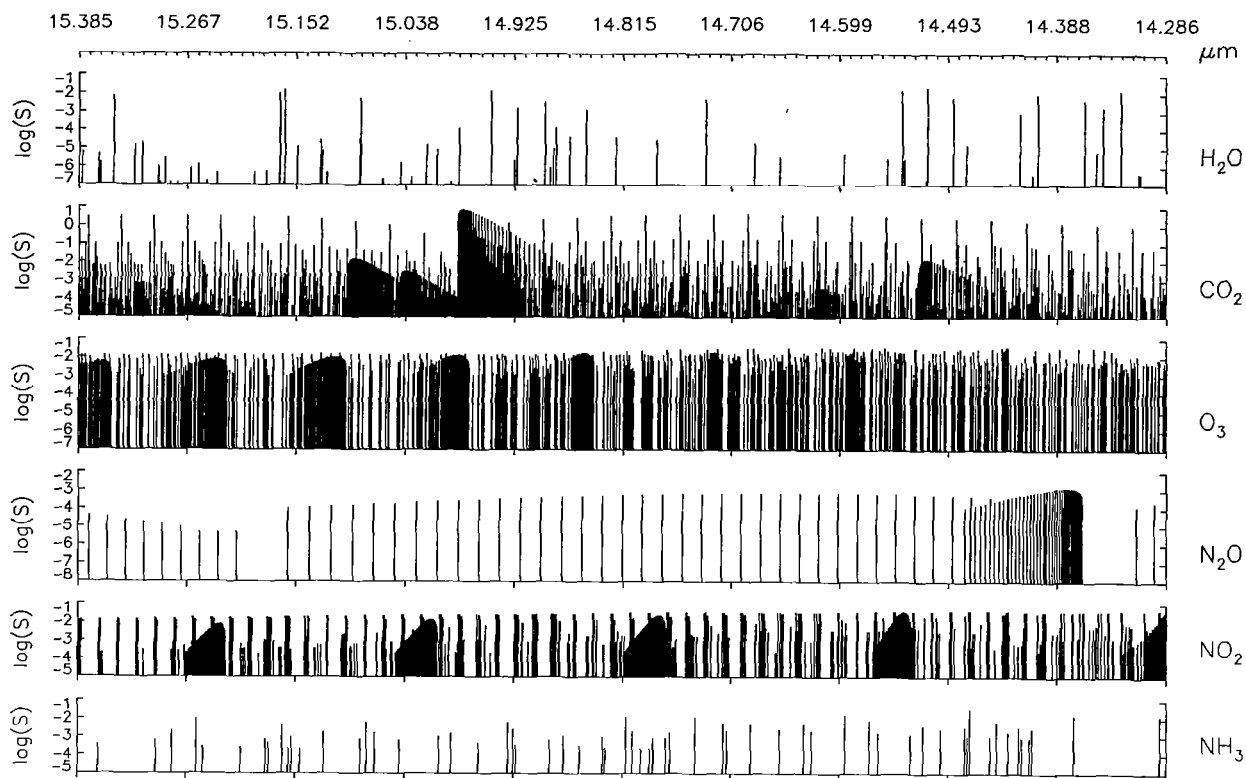




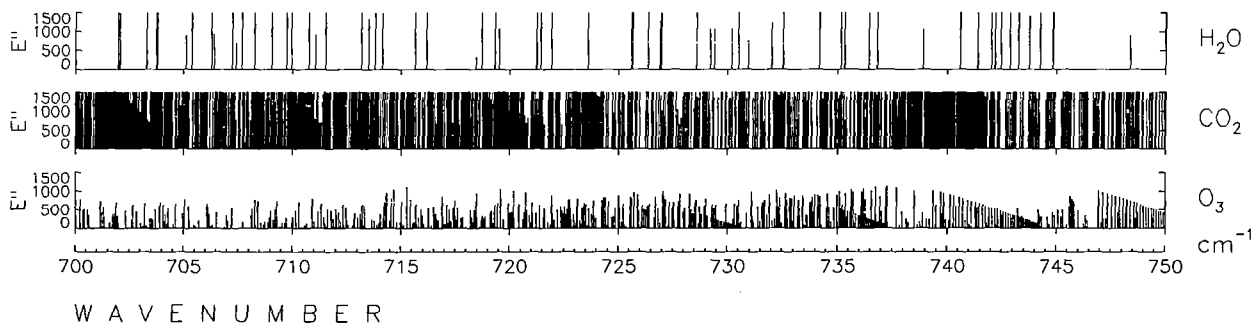
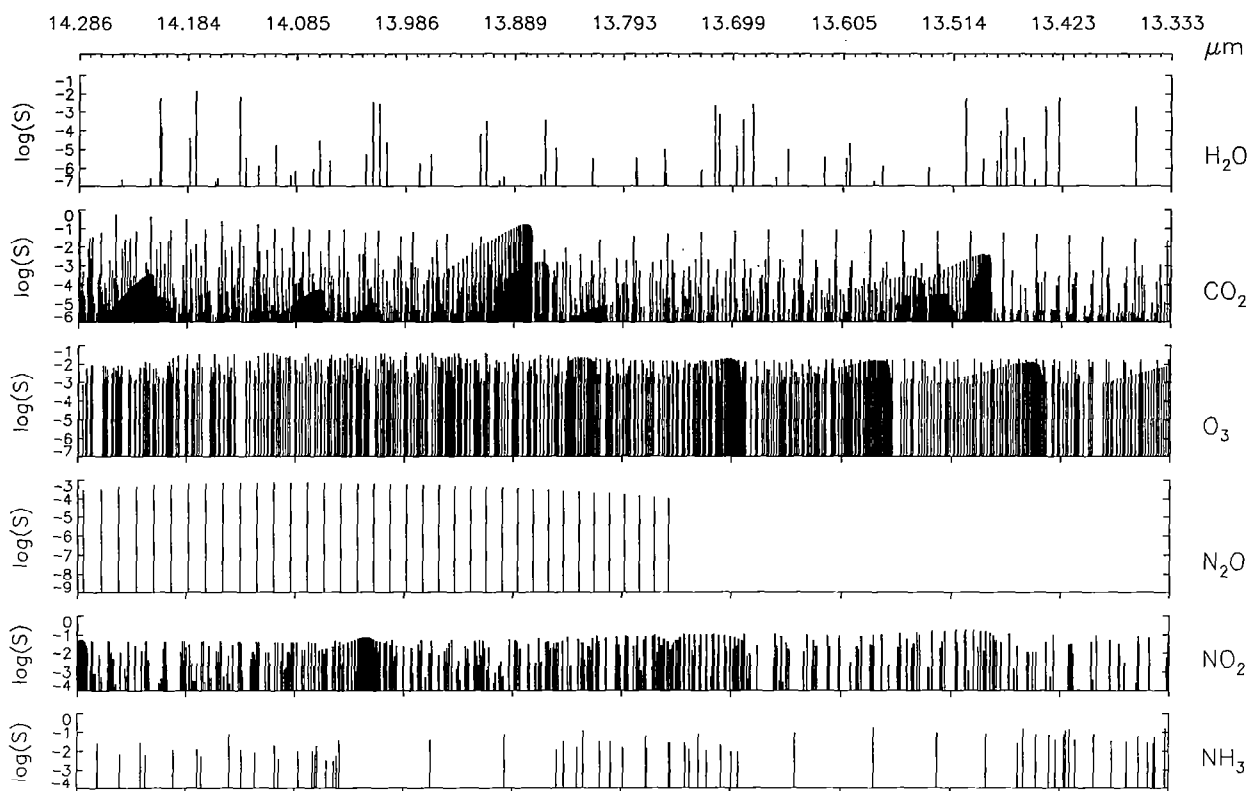


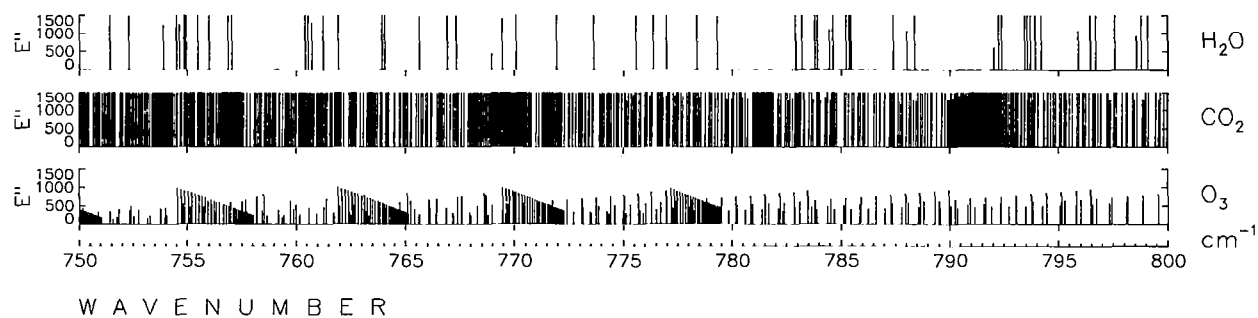
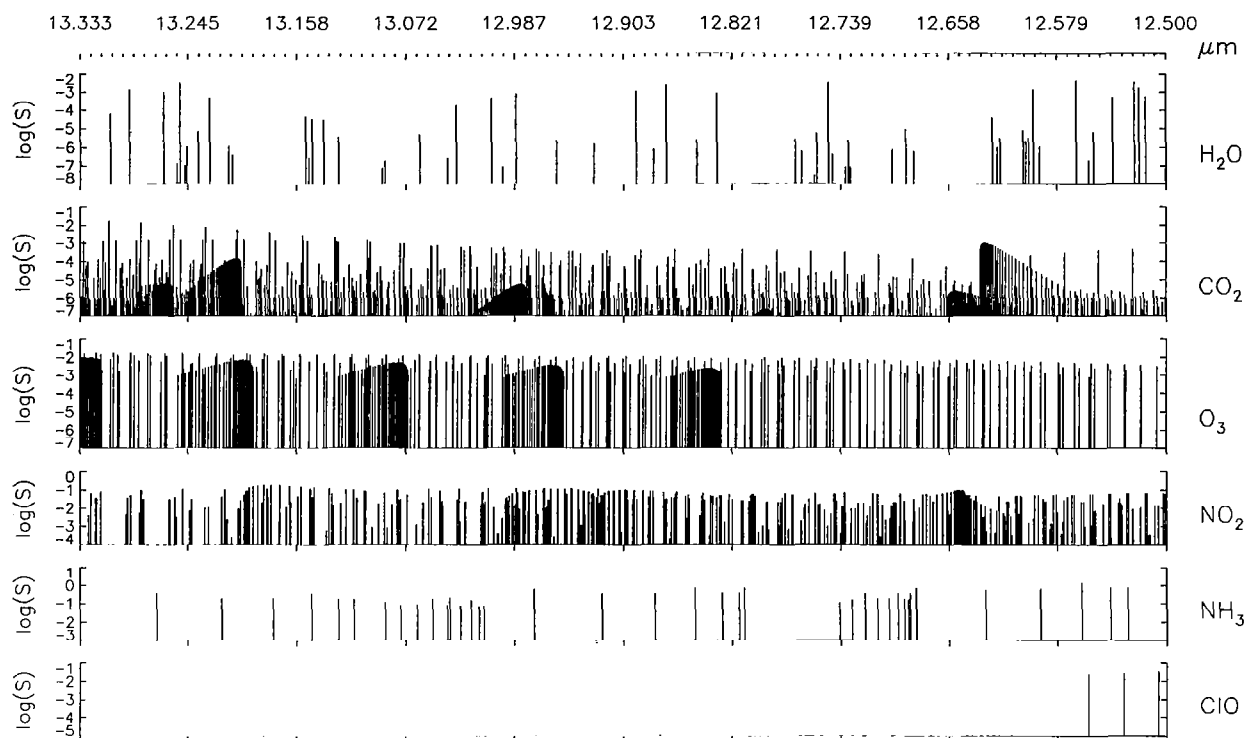


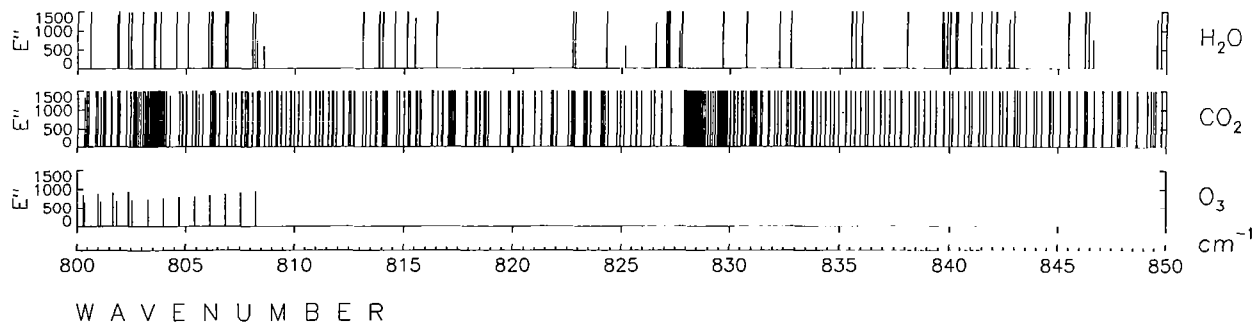
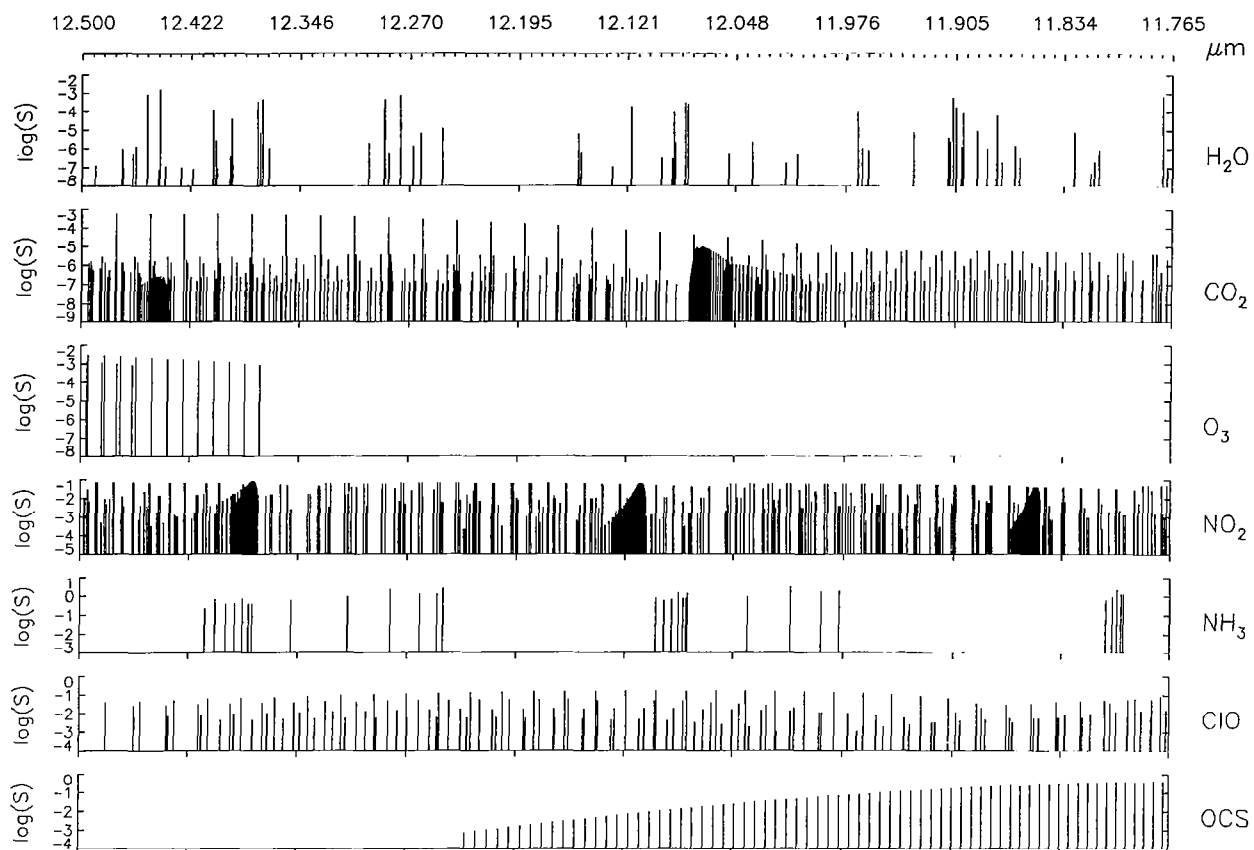


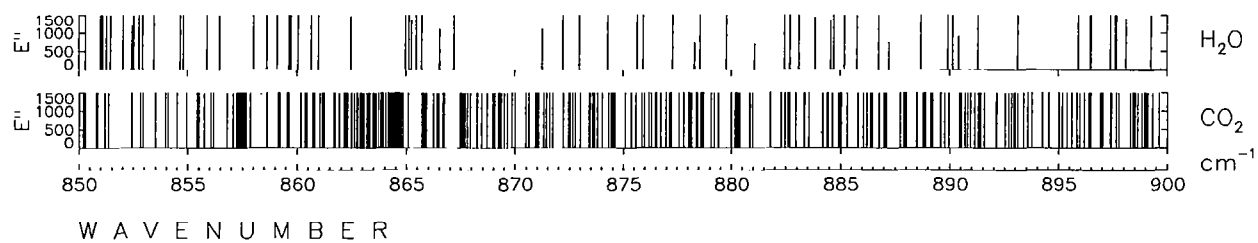
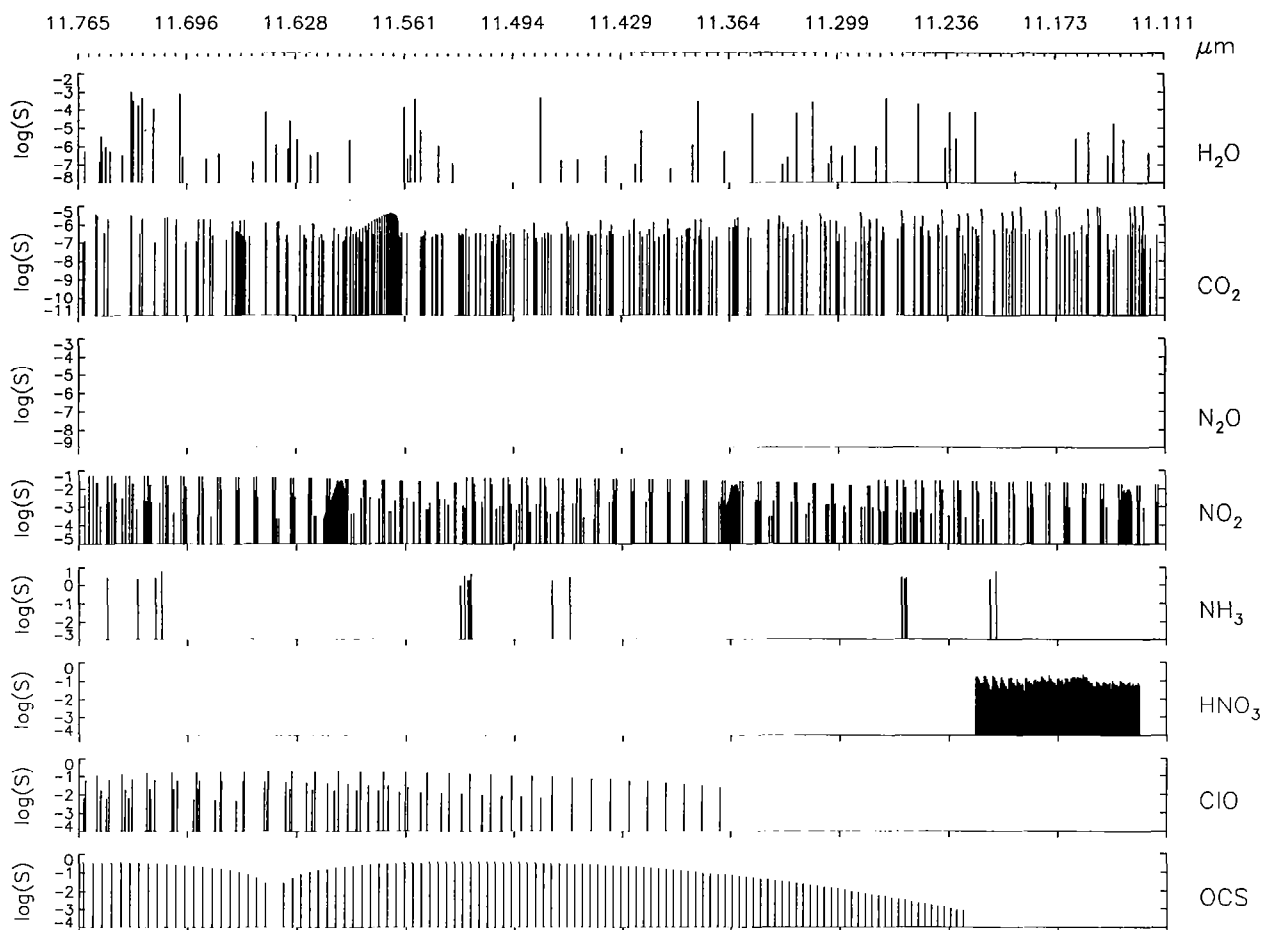


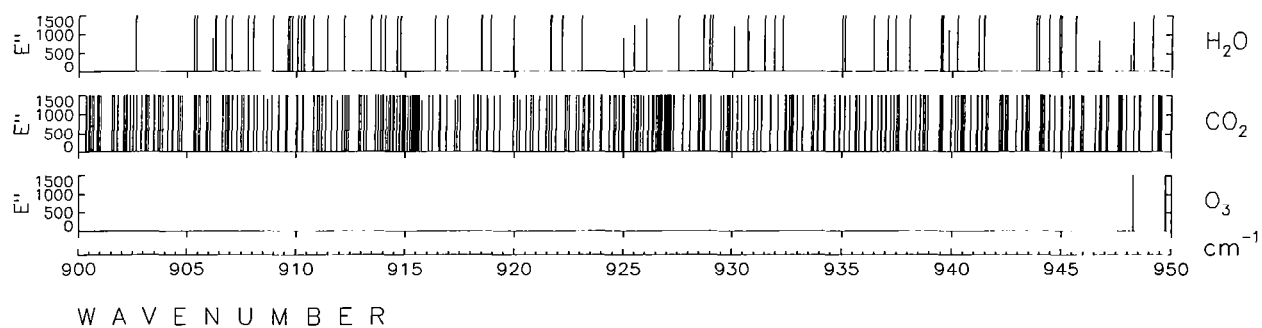
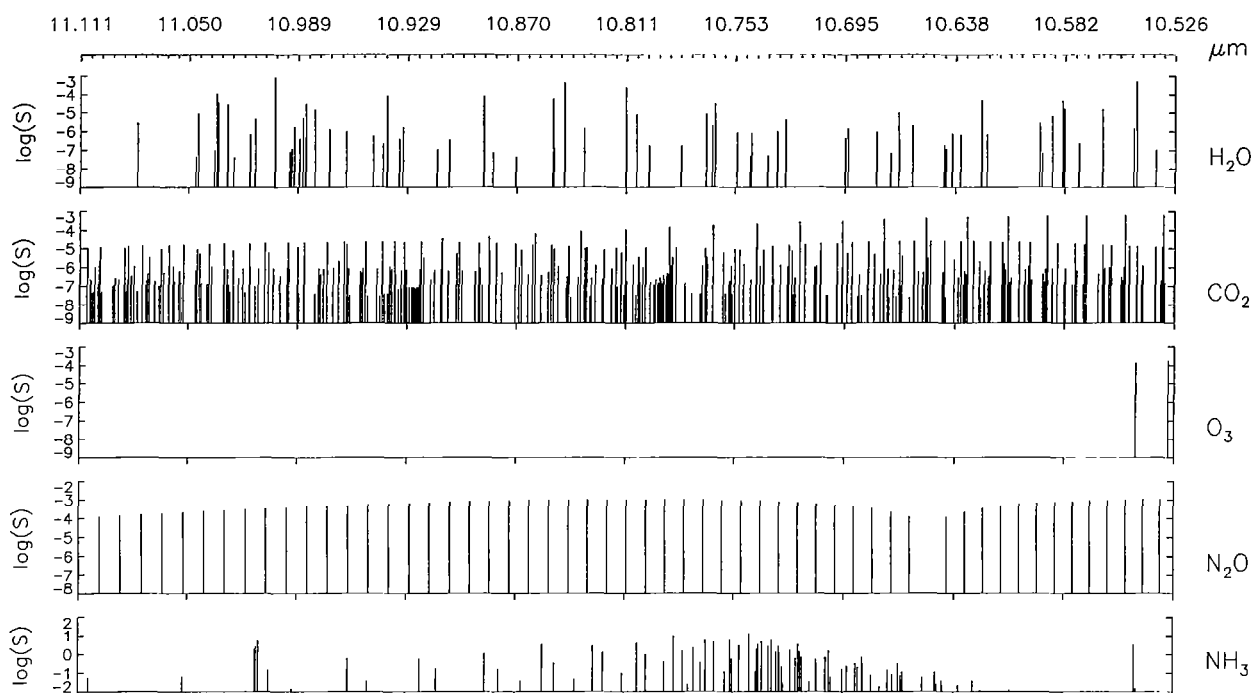


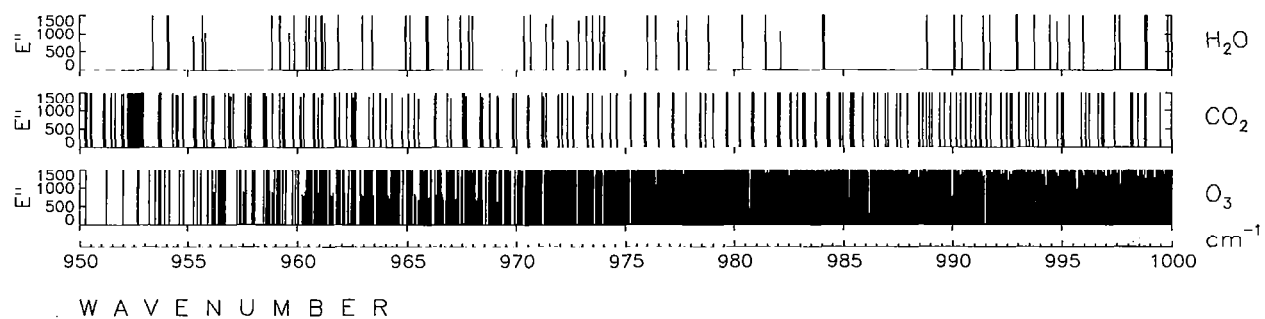
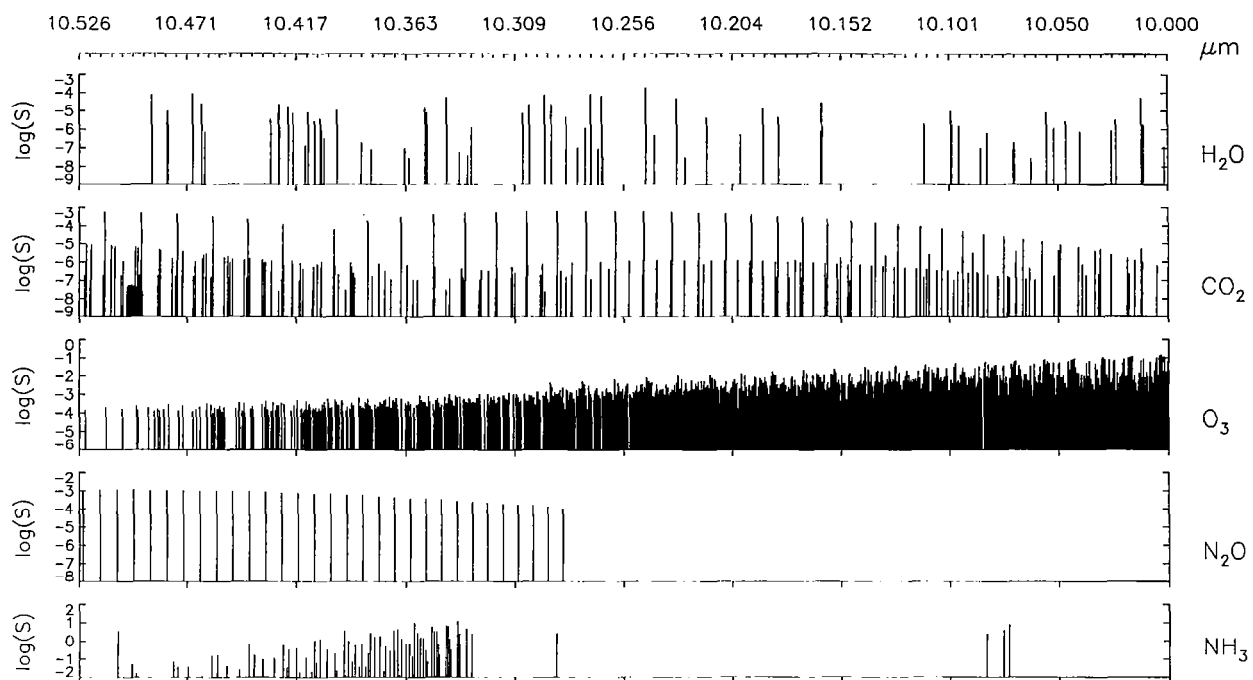


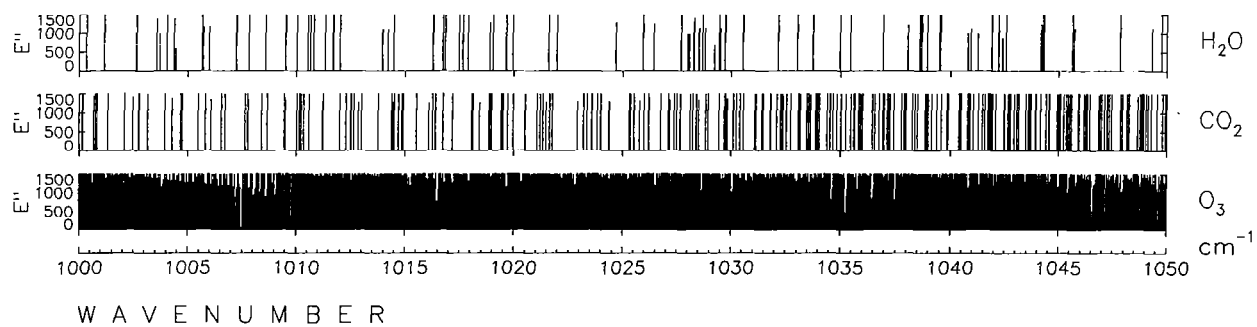
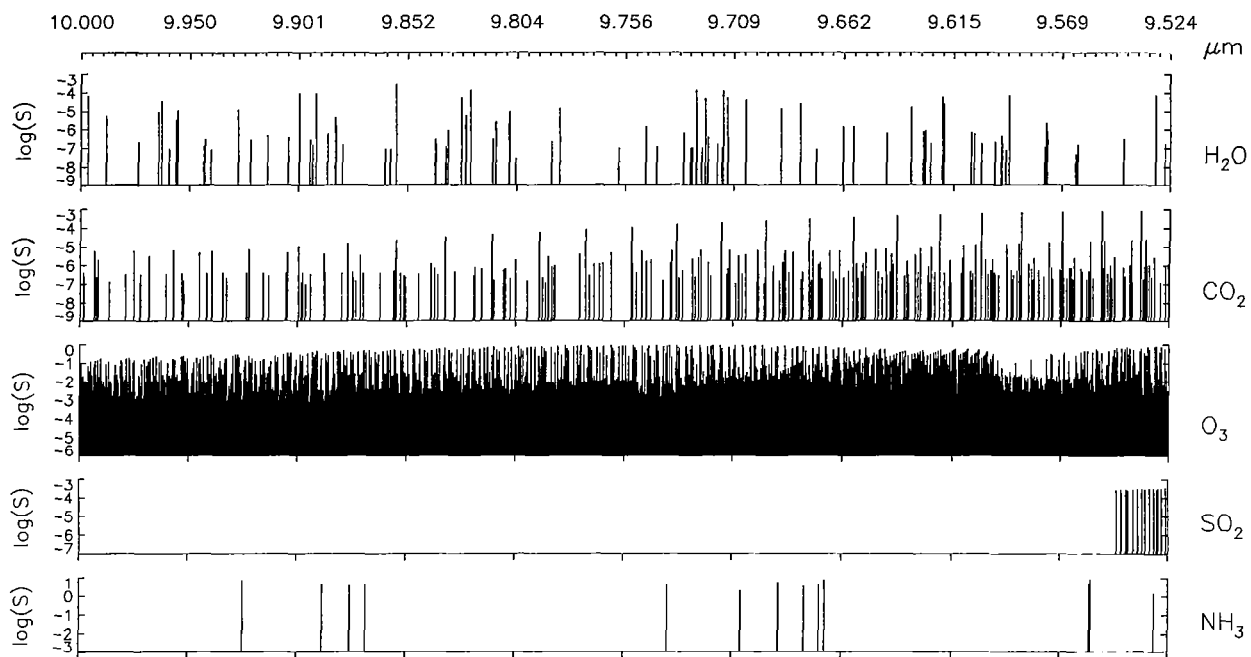


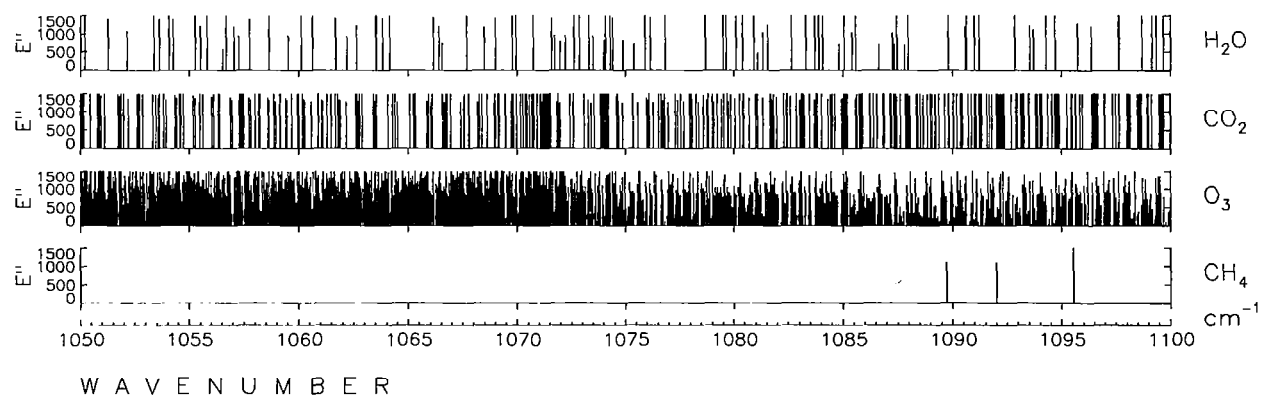
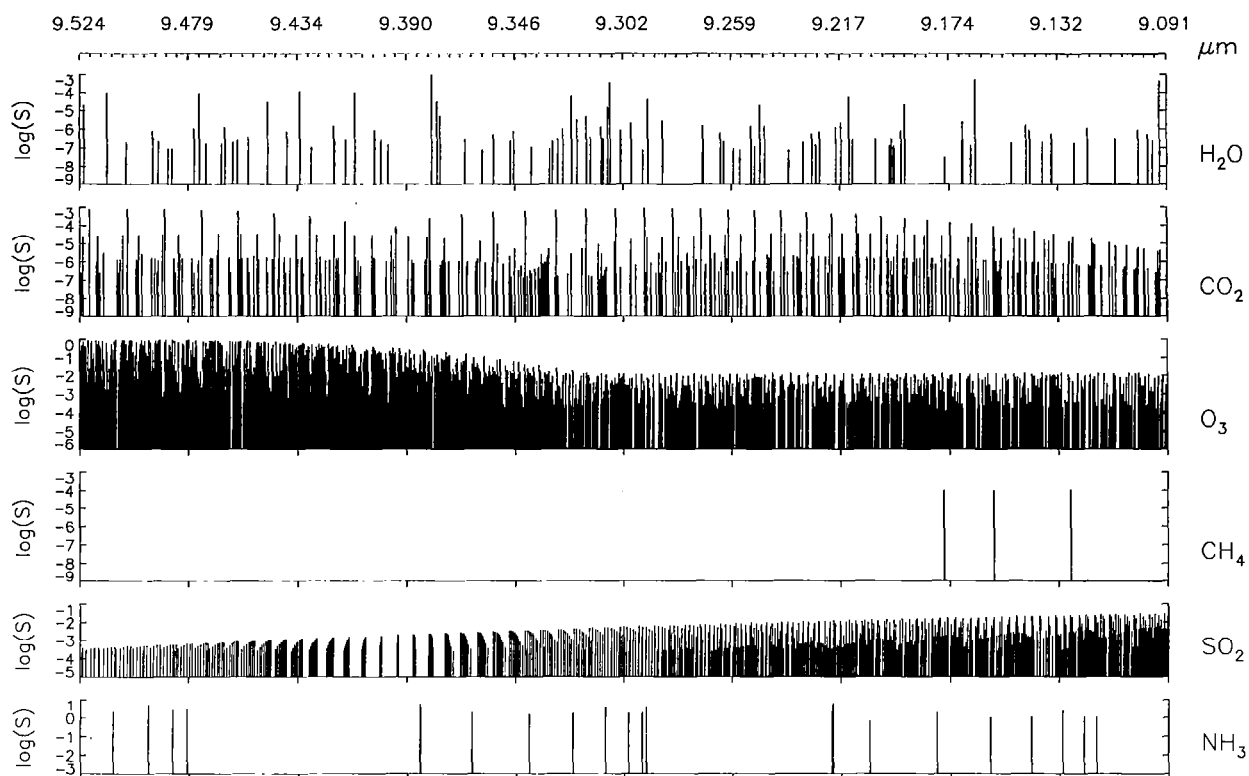




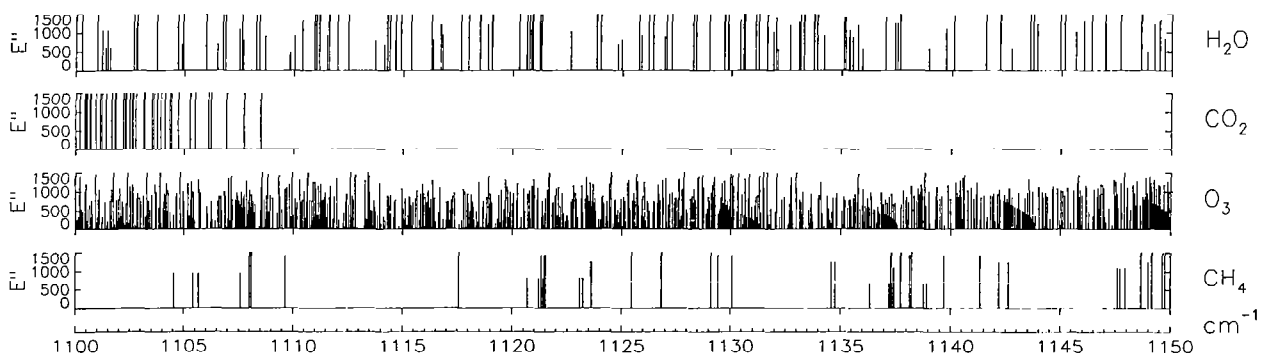
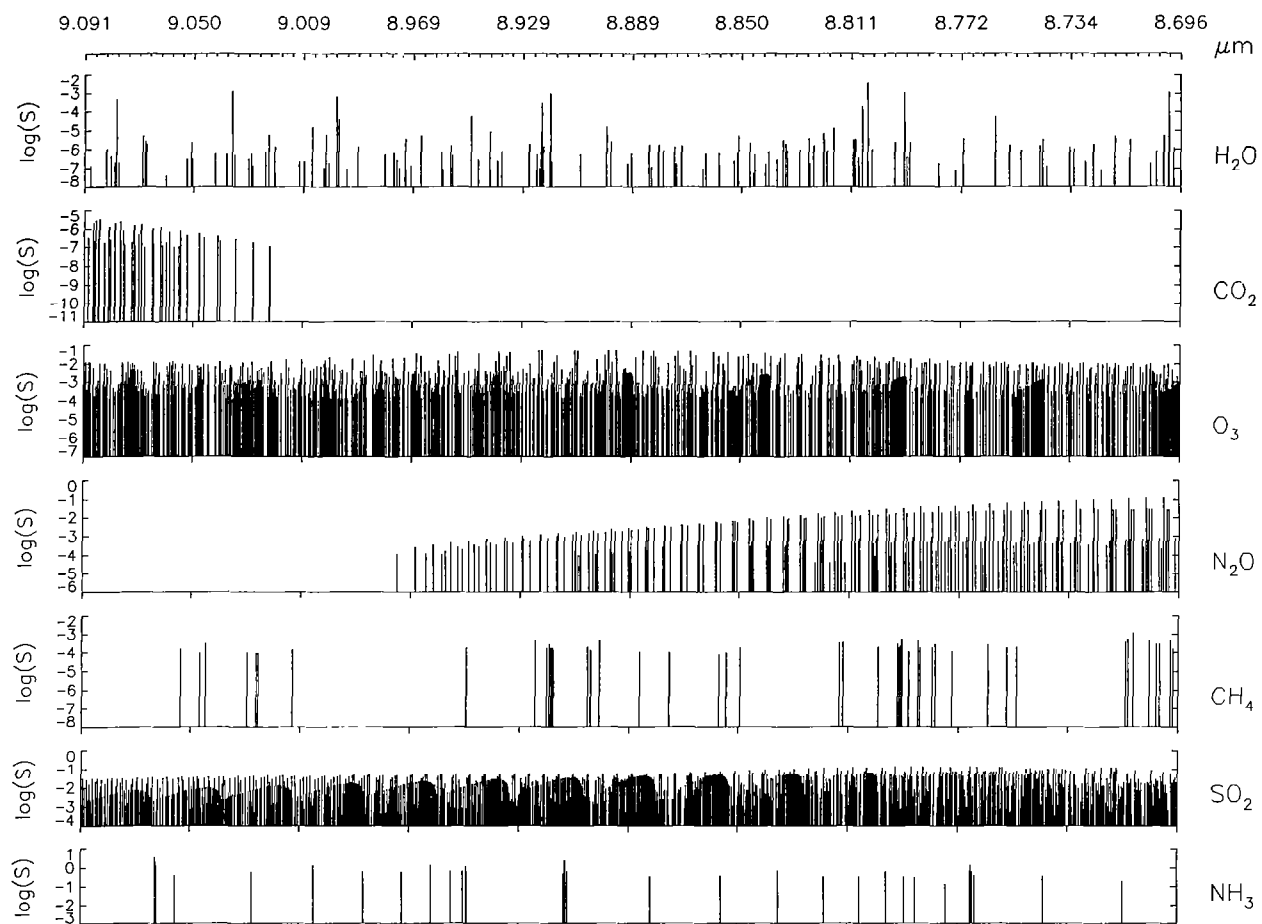




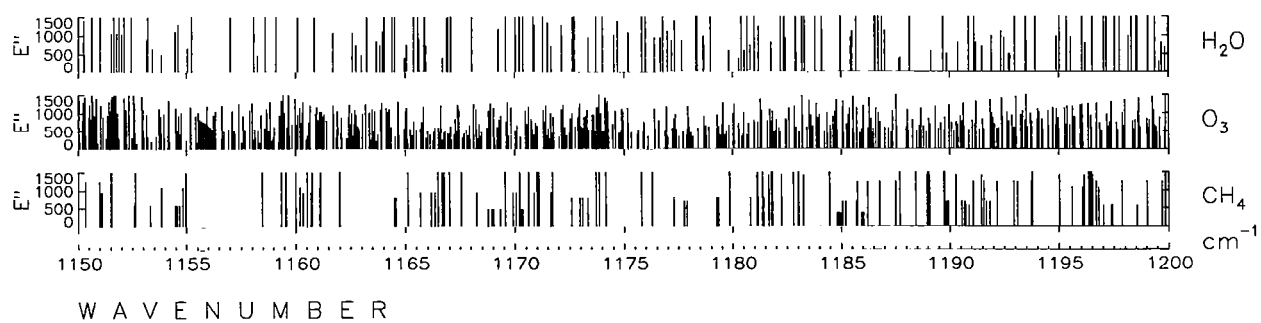
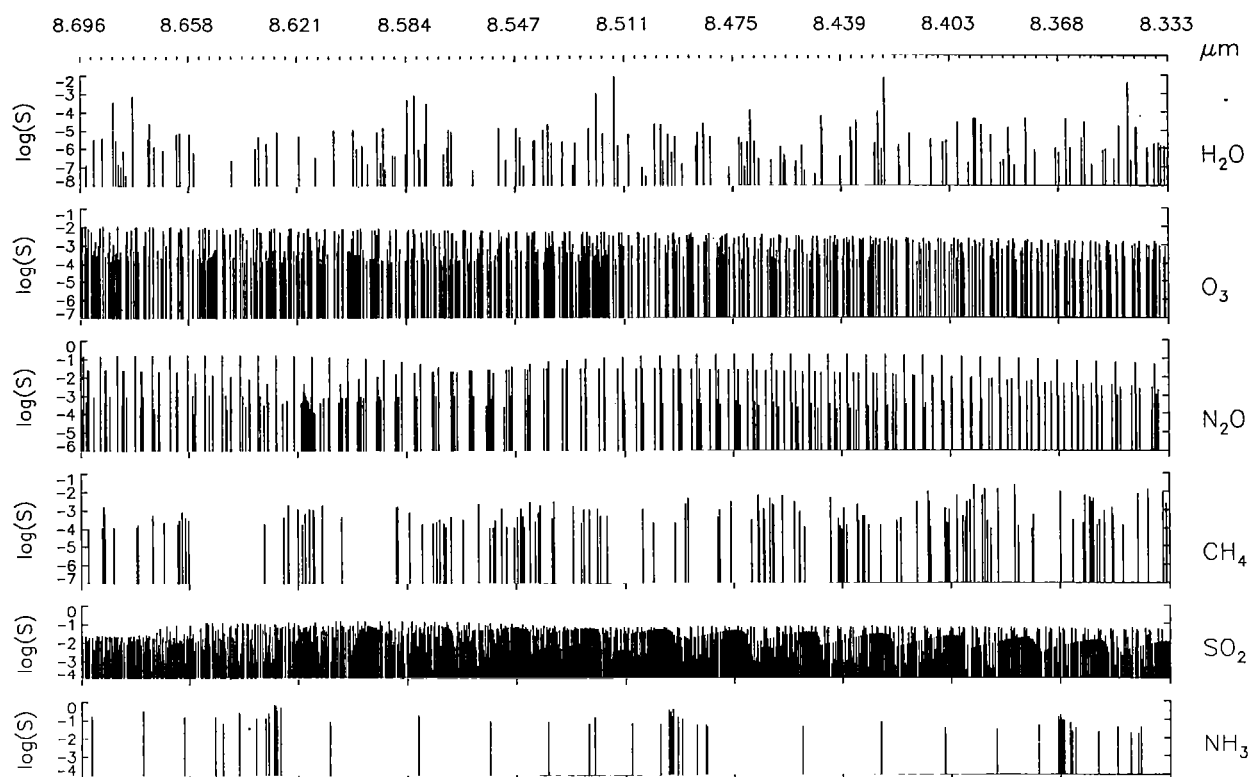


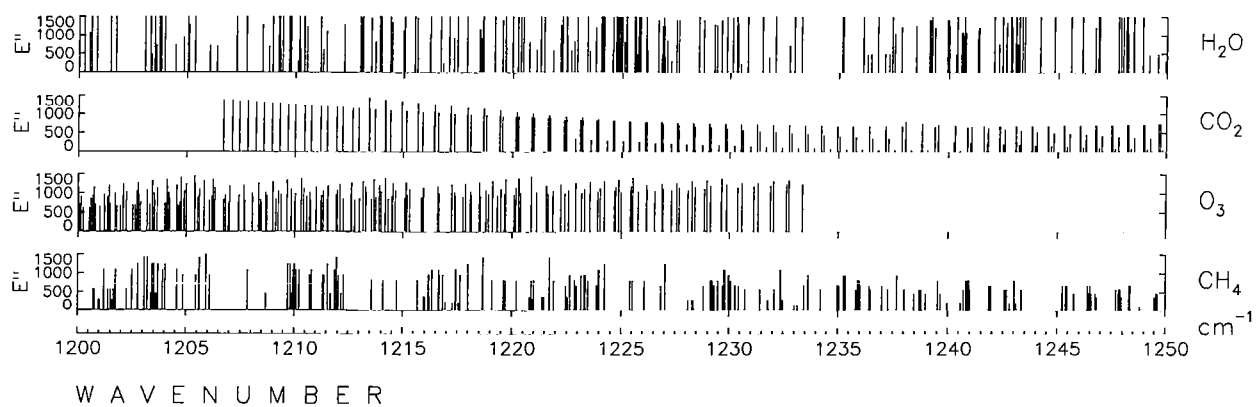
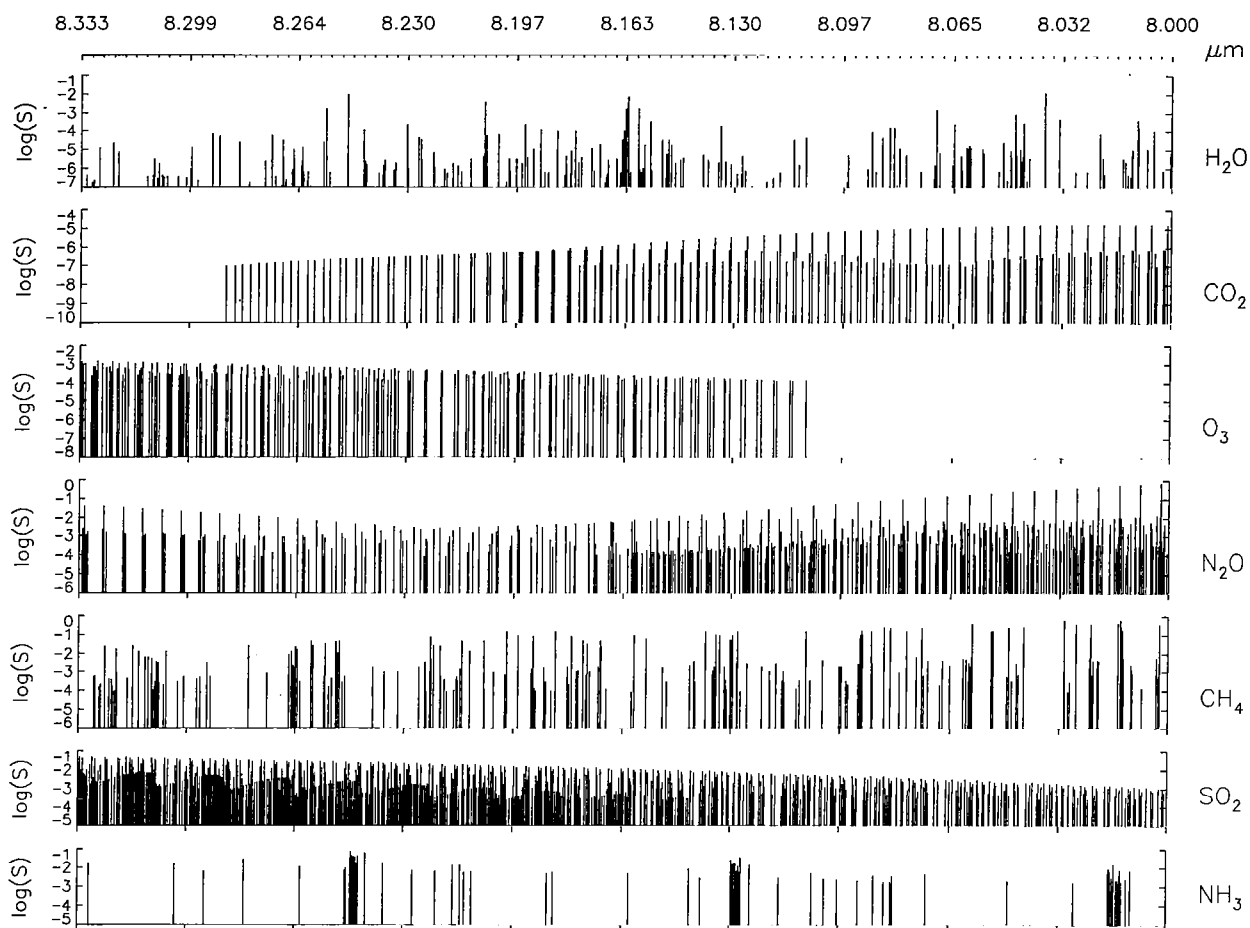


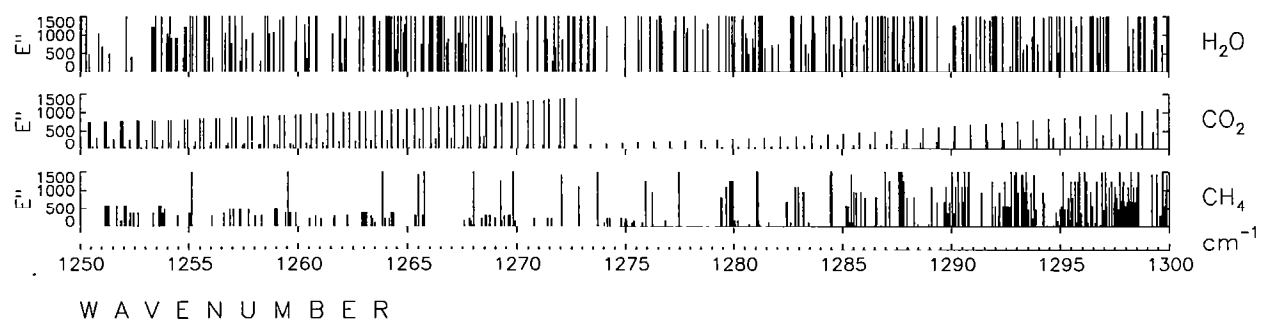
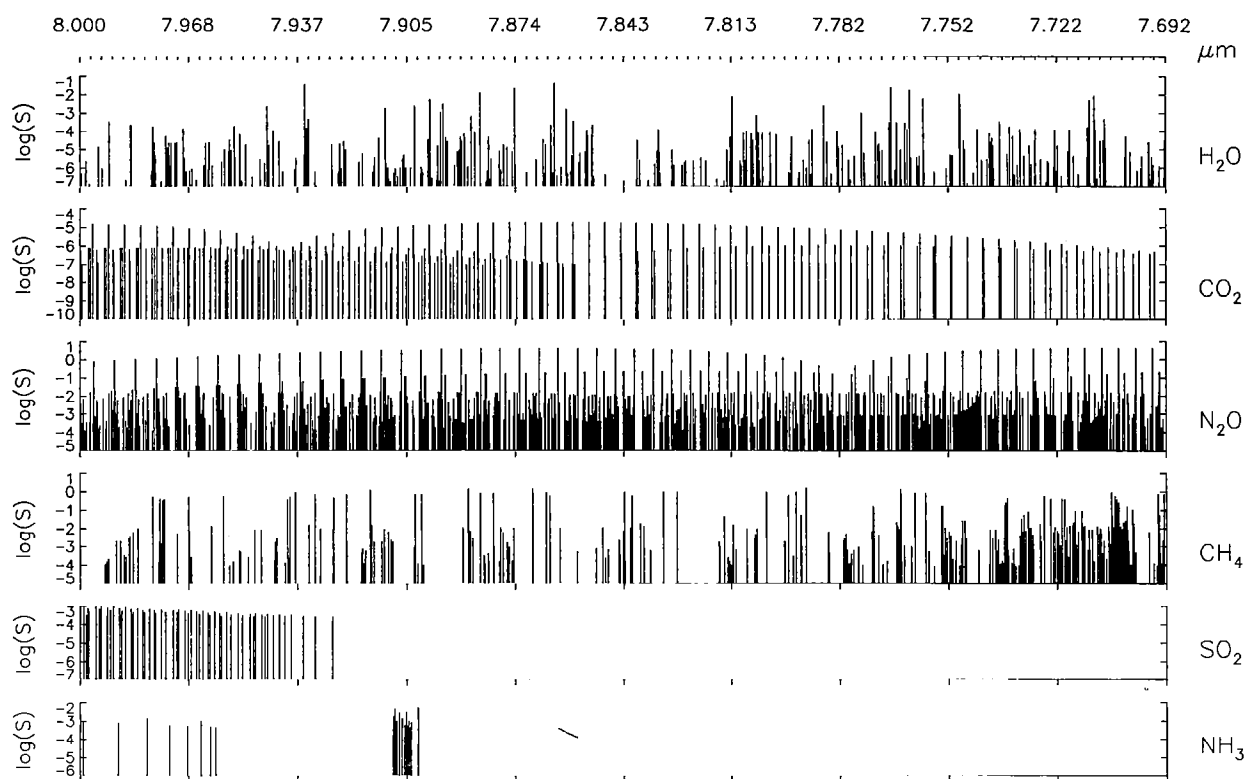


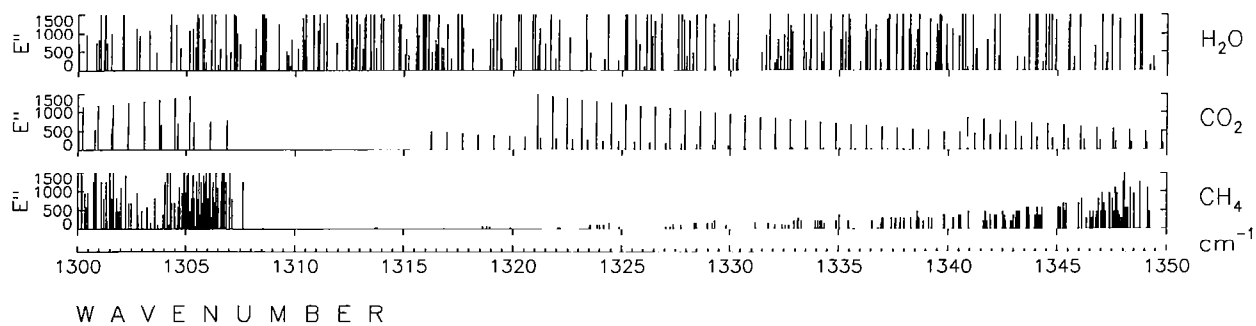
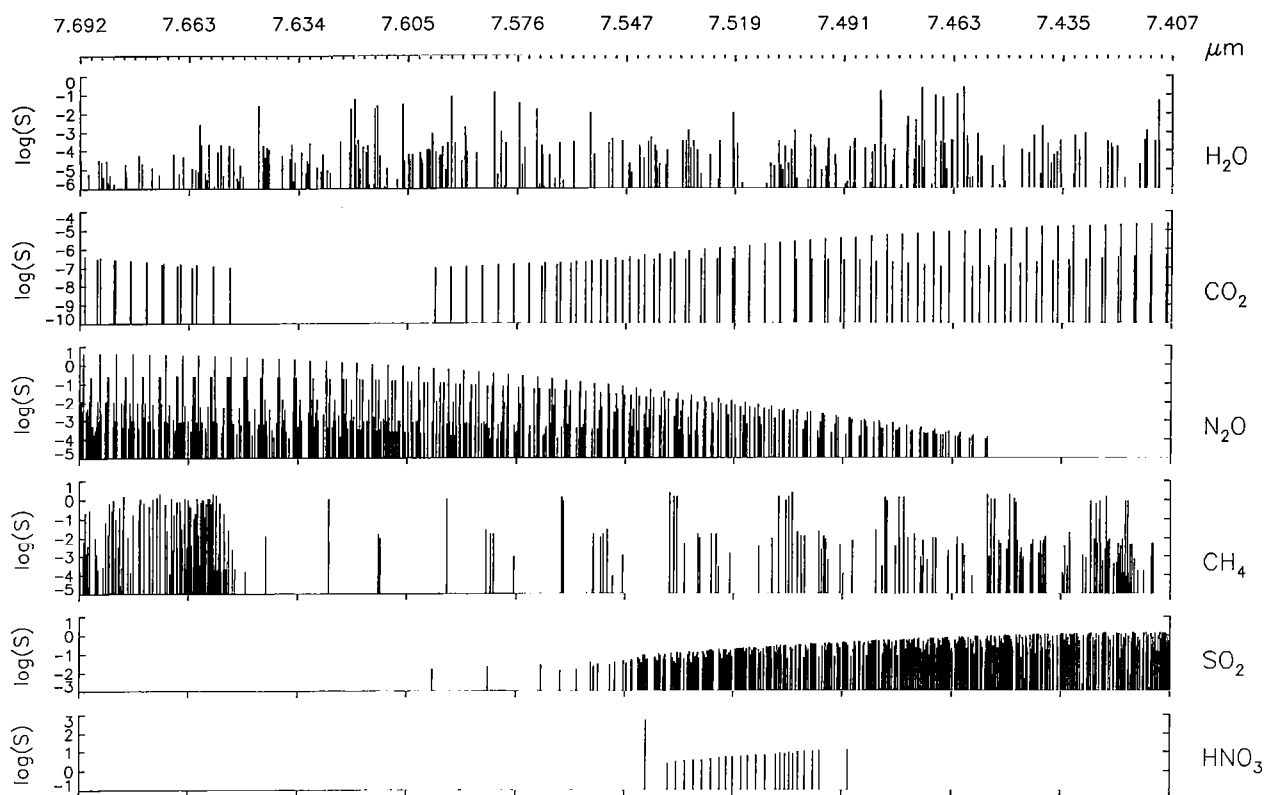


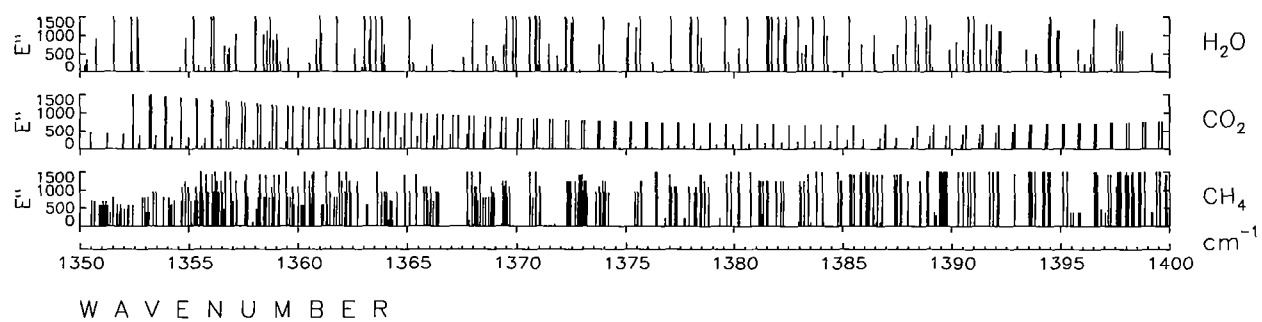
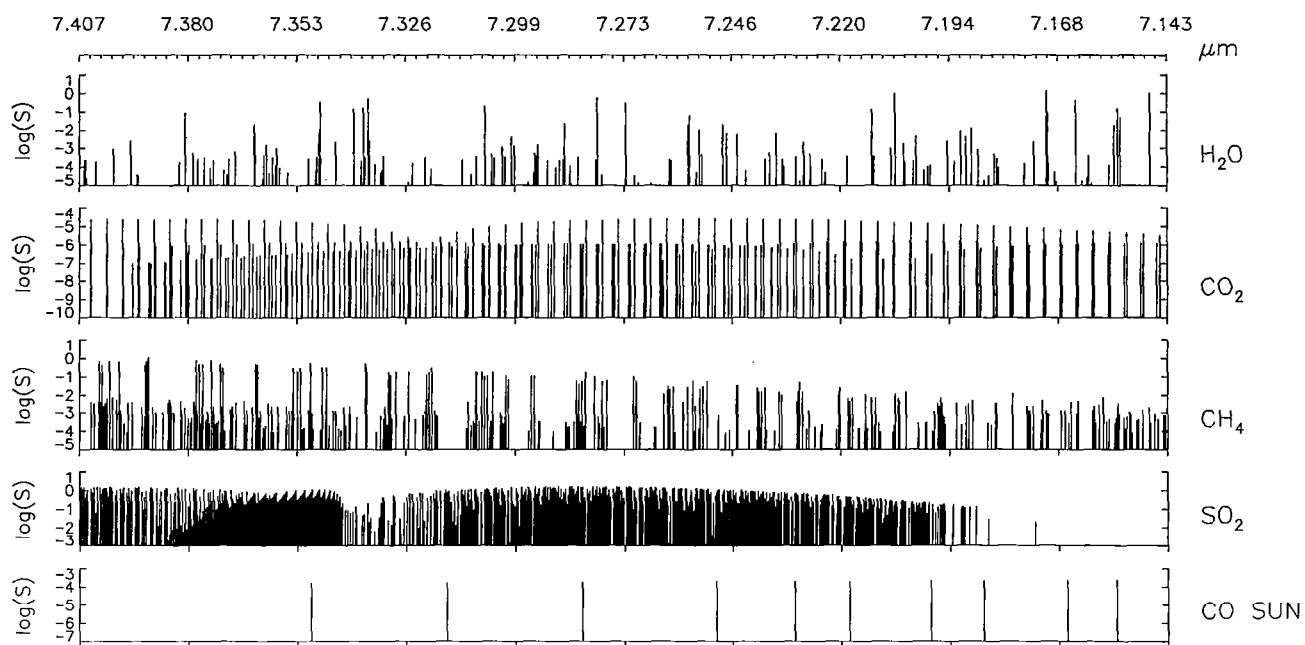
W A V E N U M B E R

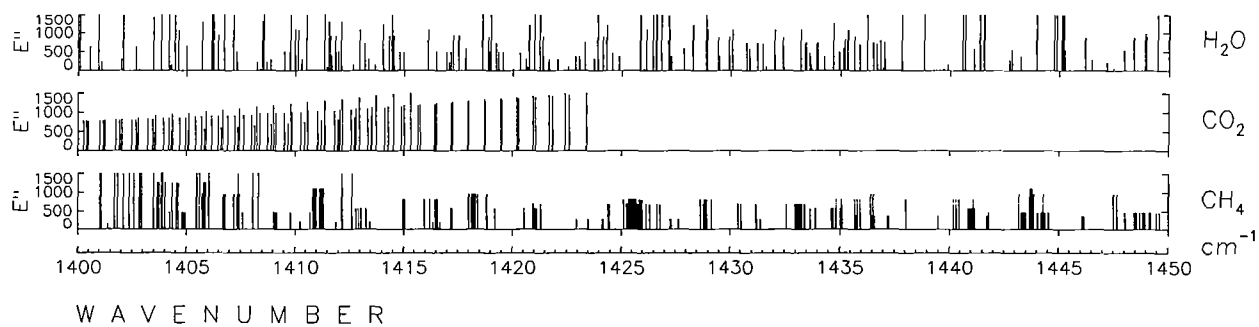
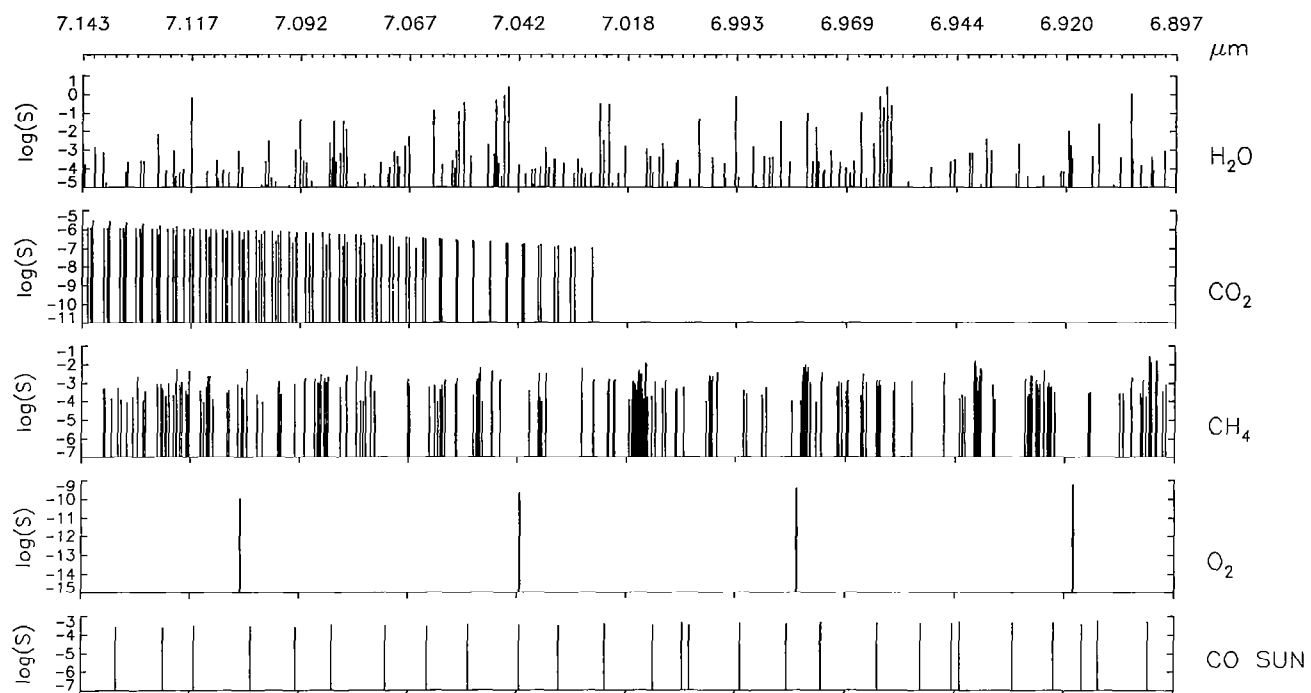


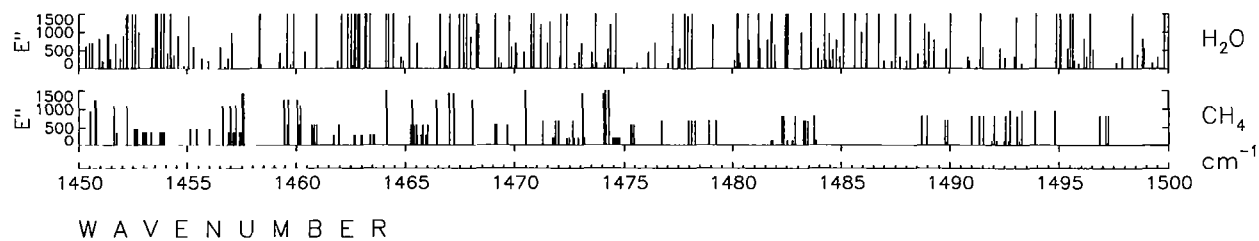
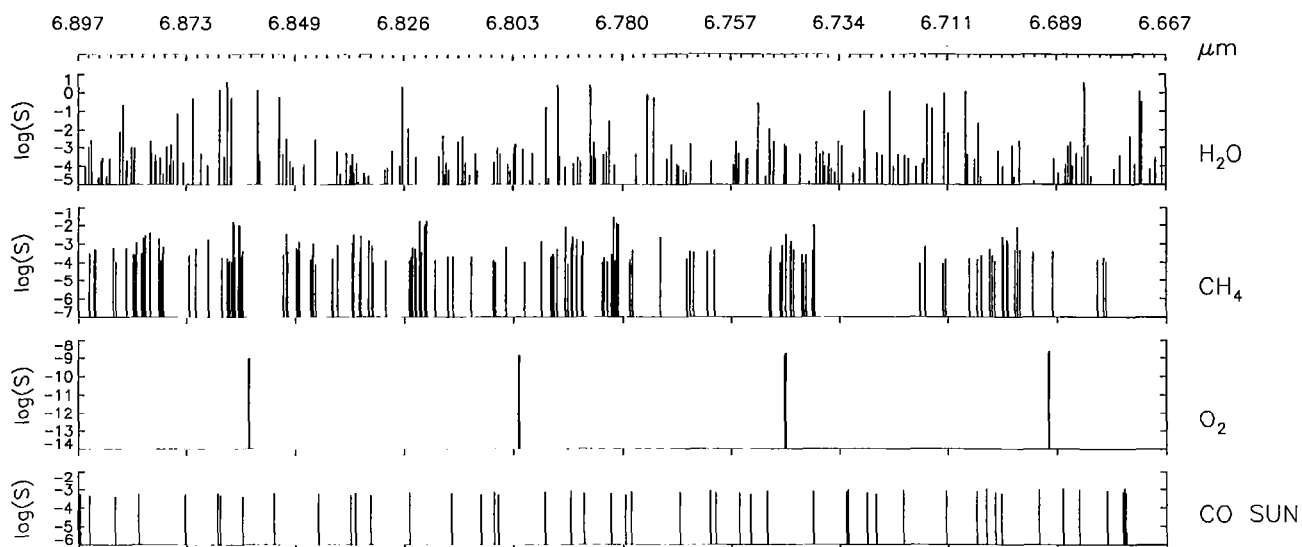




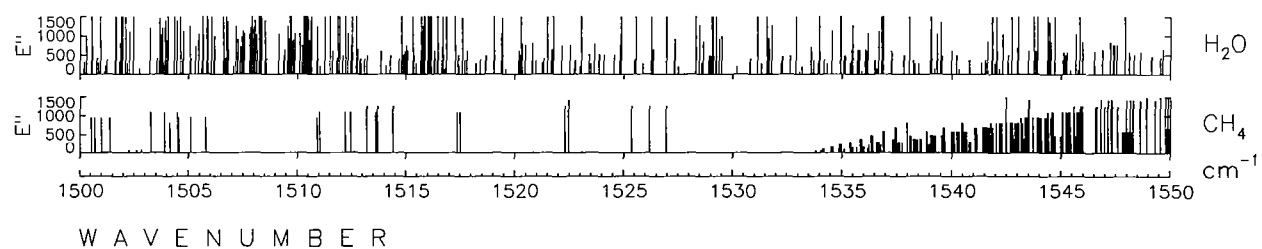
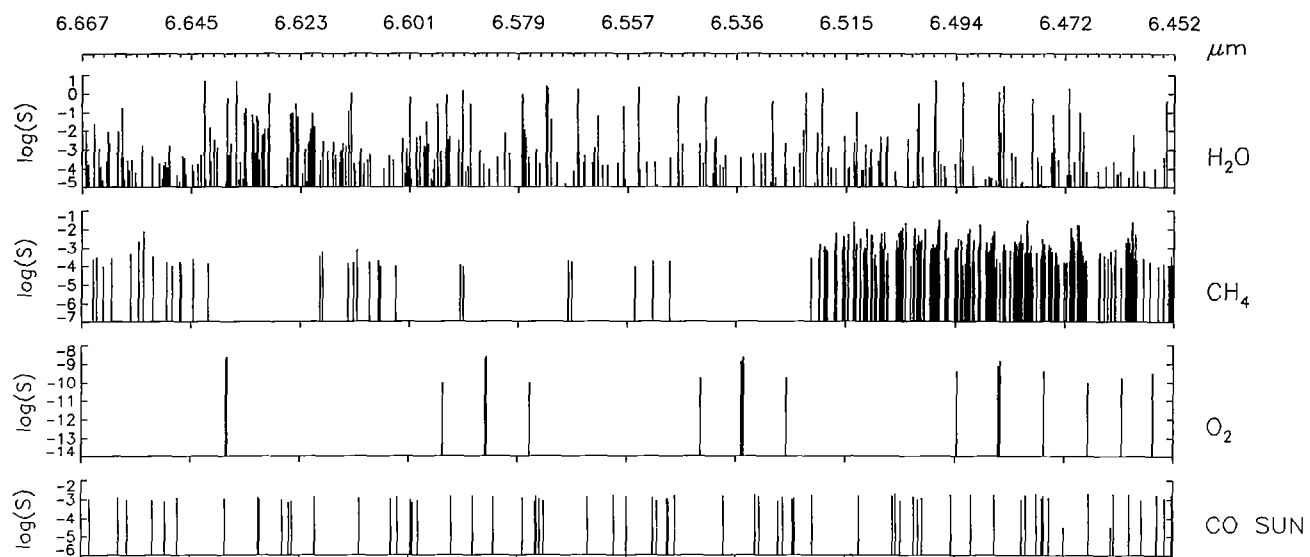


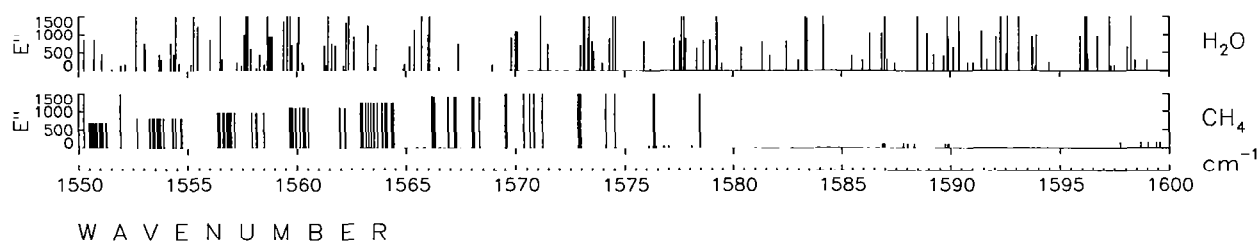
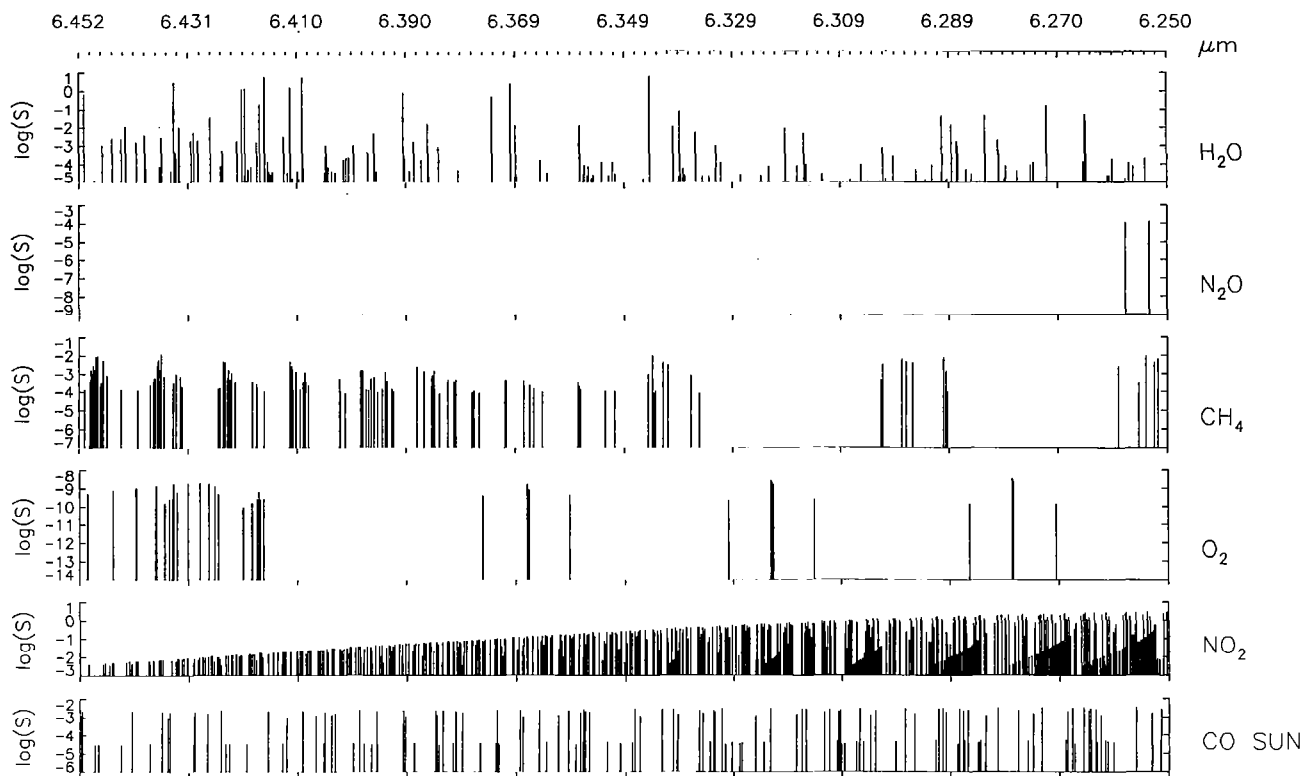


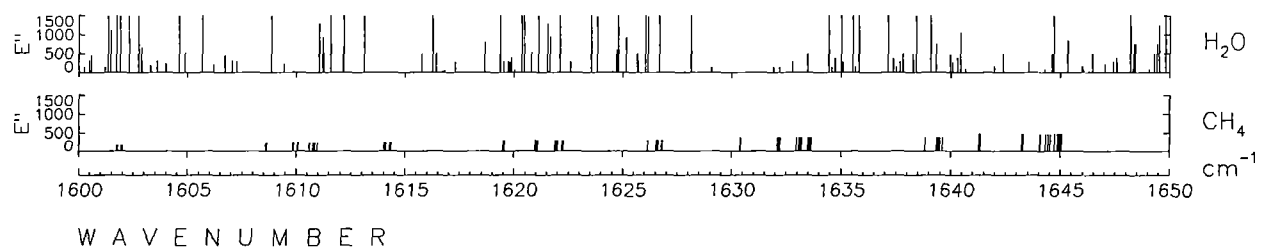
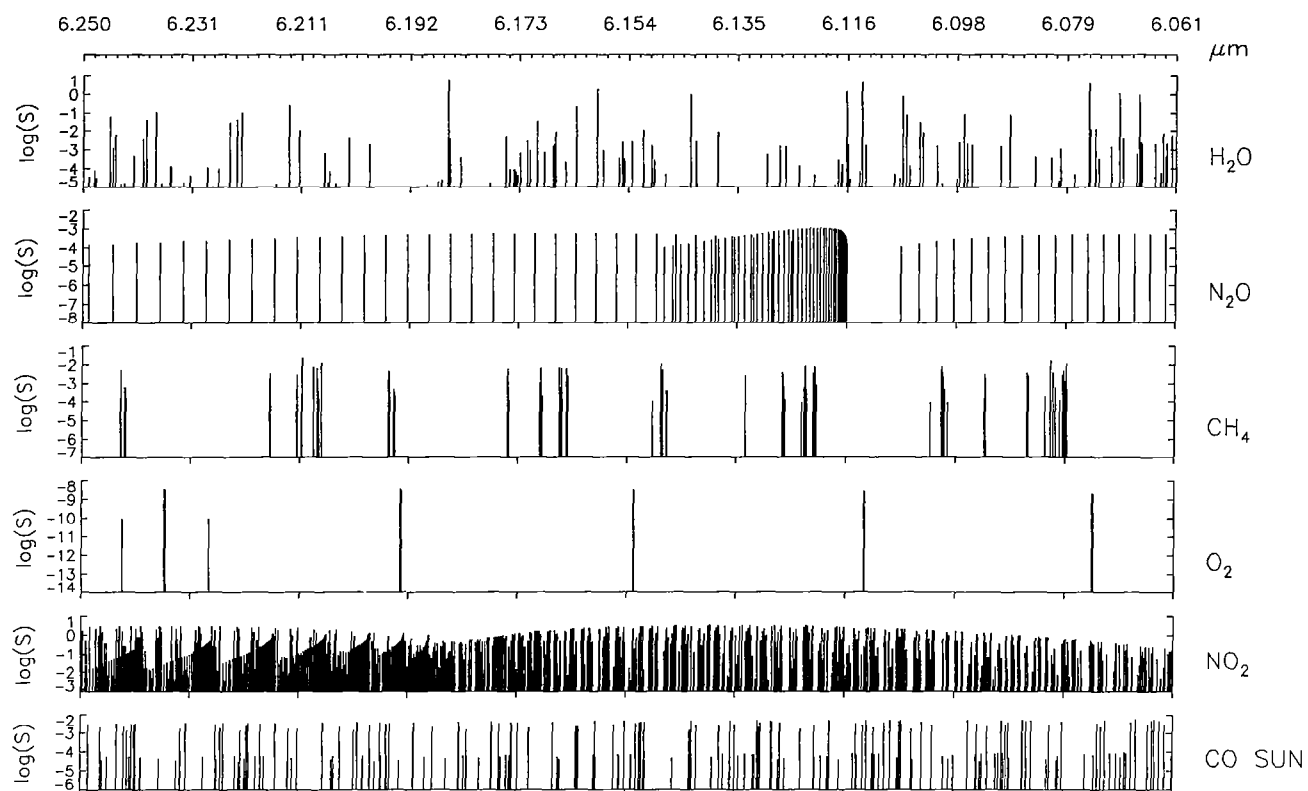


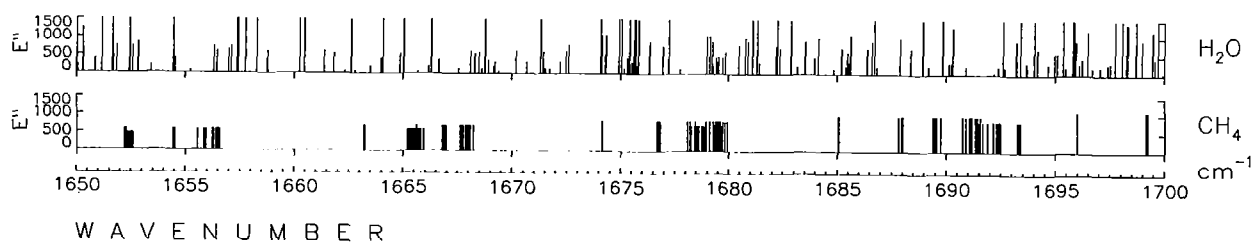
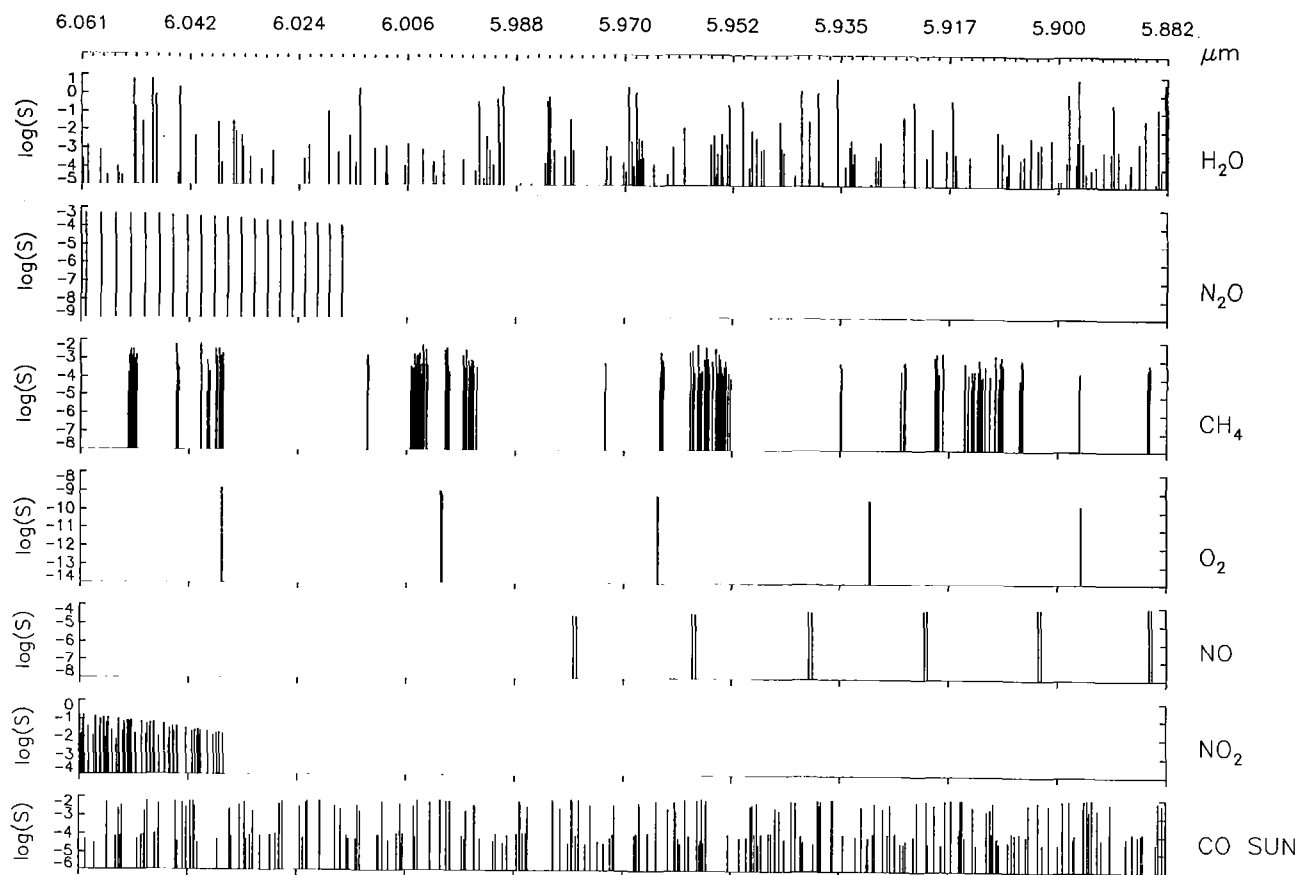


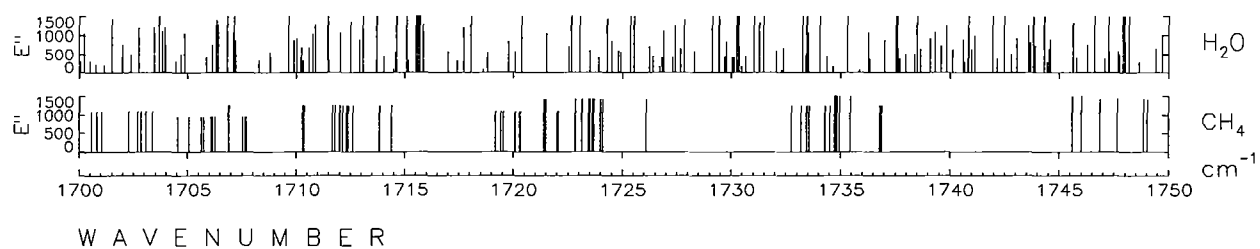
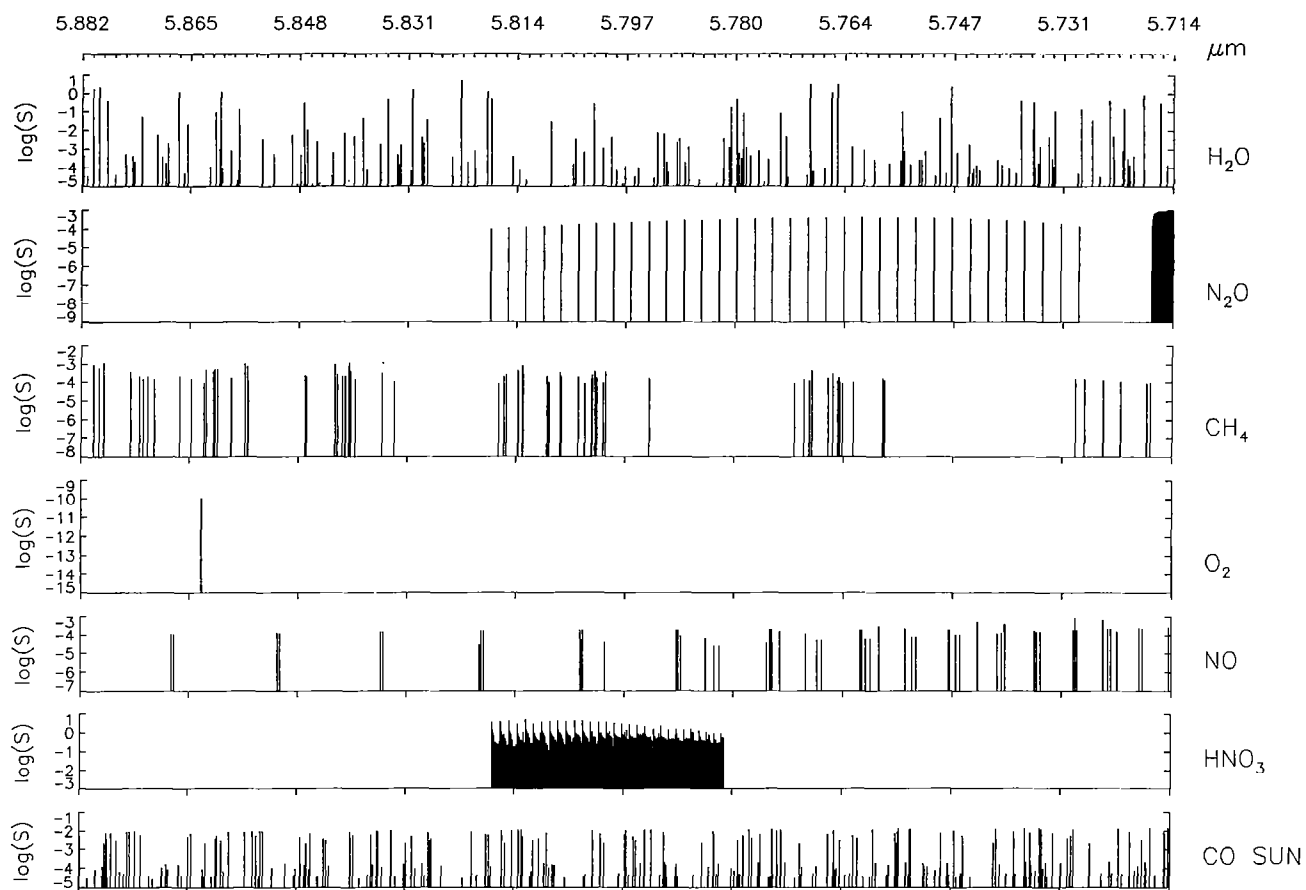


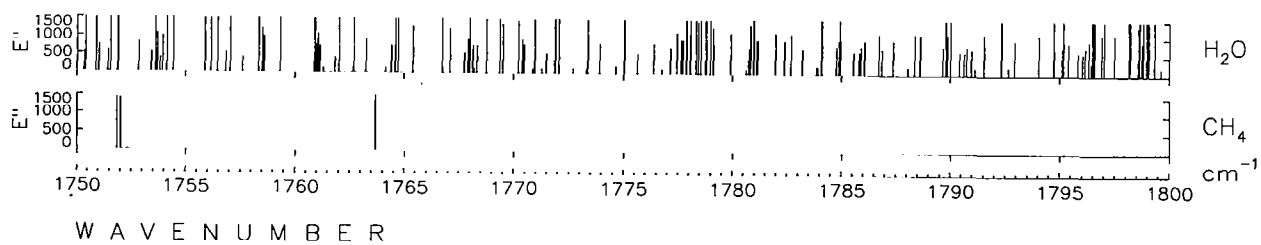
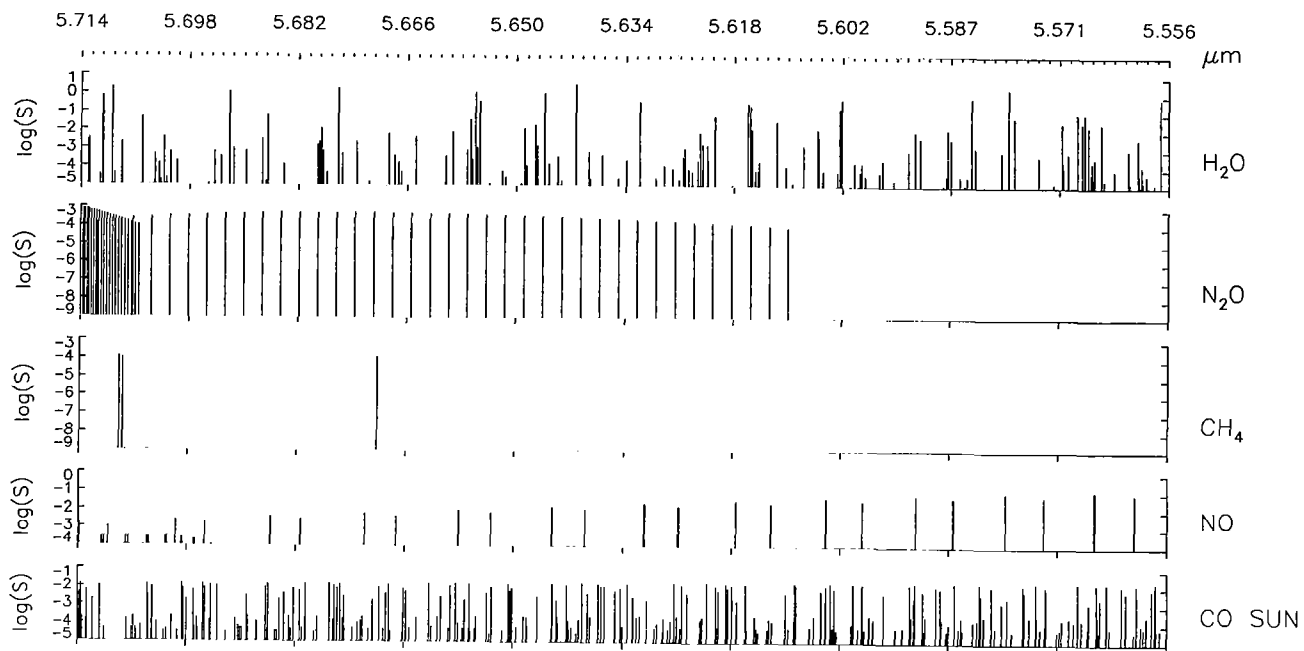


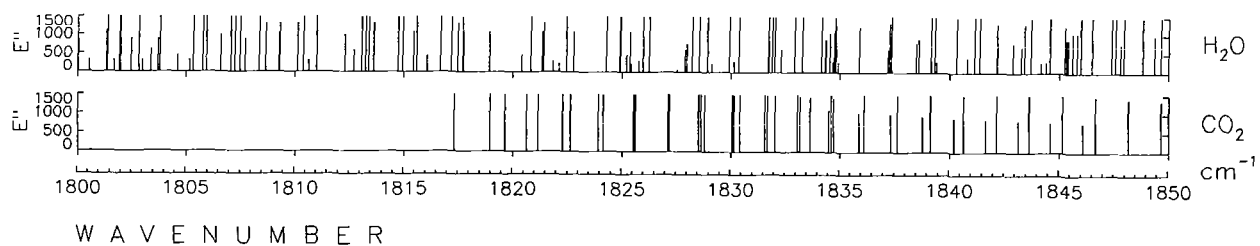
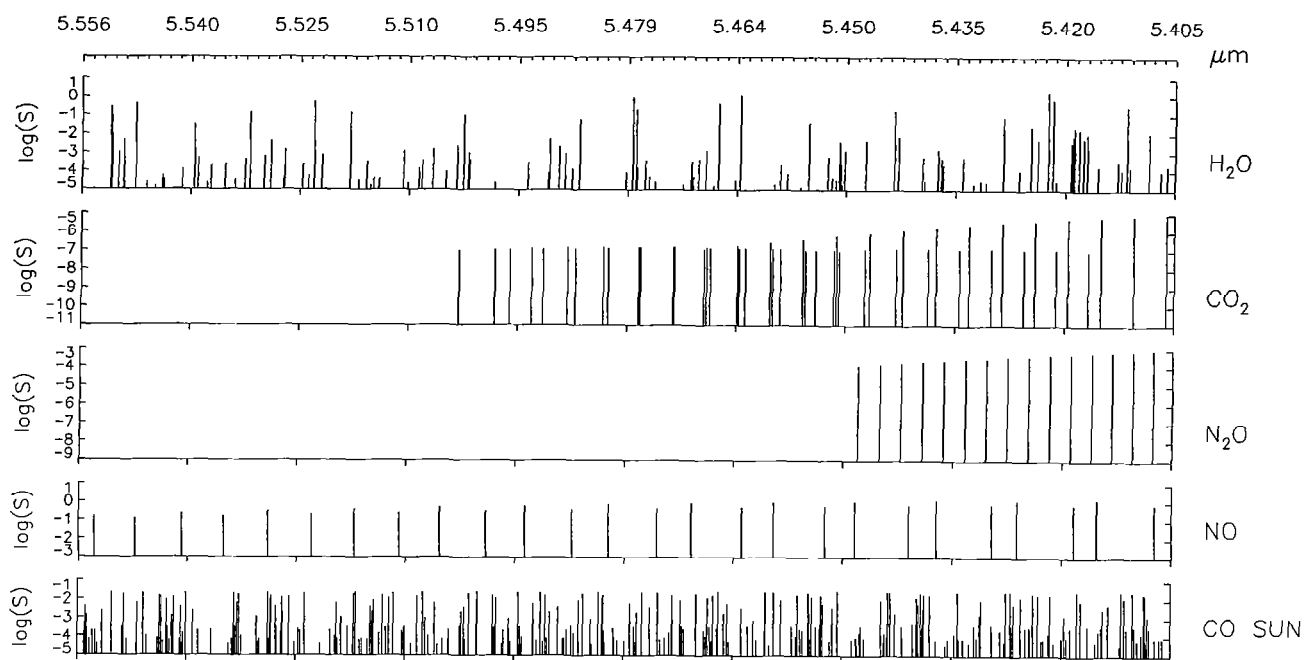


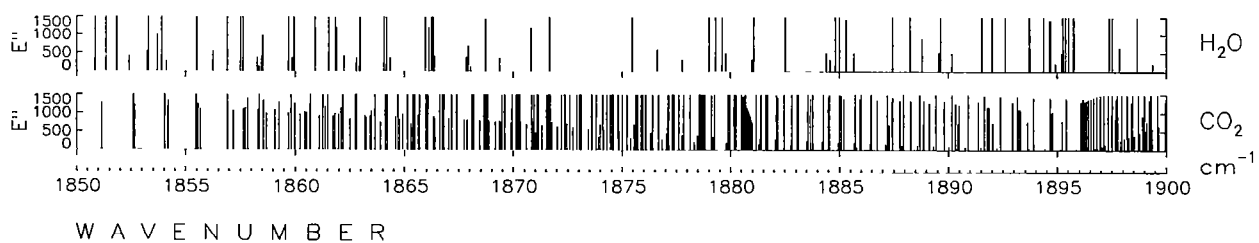
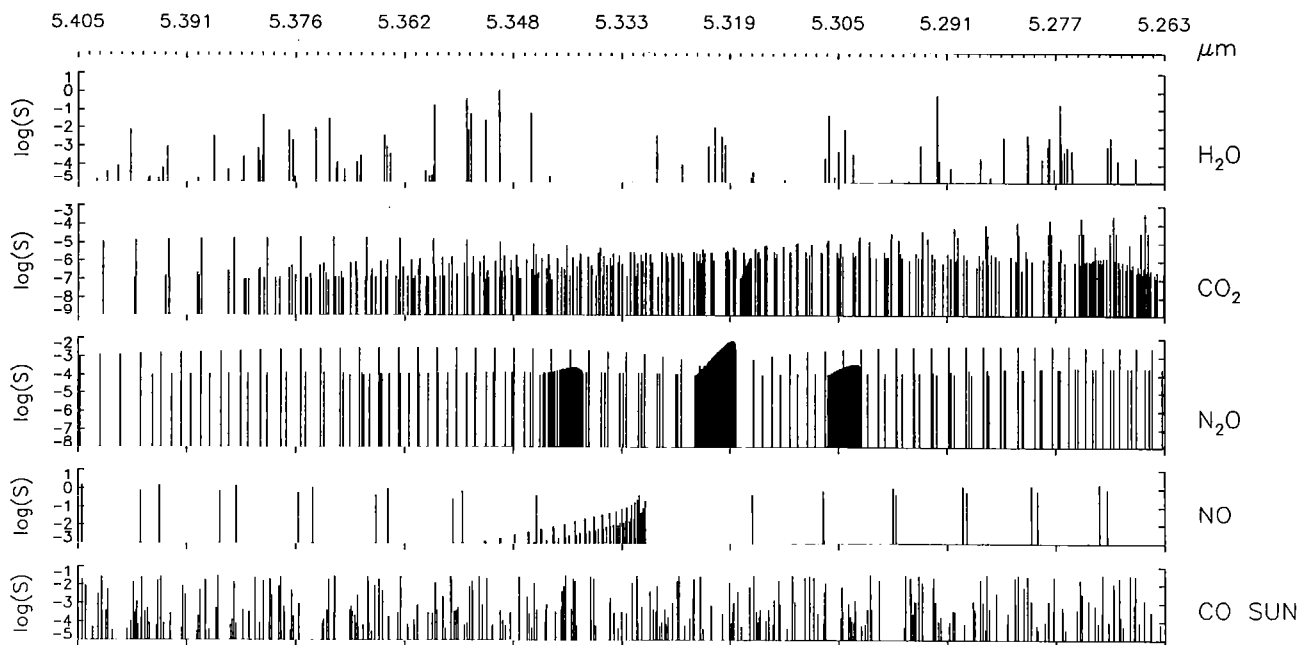




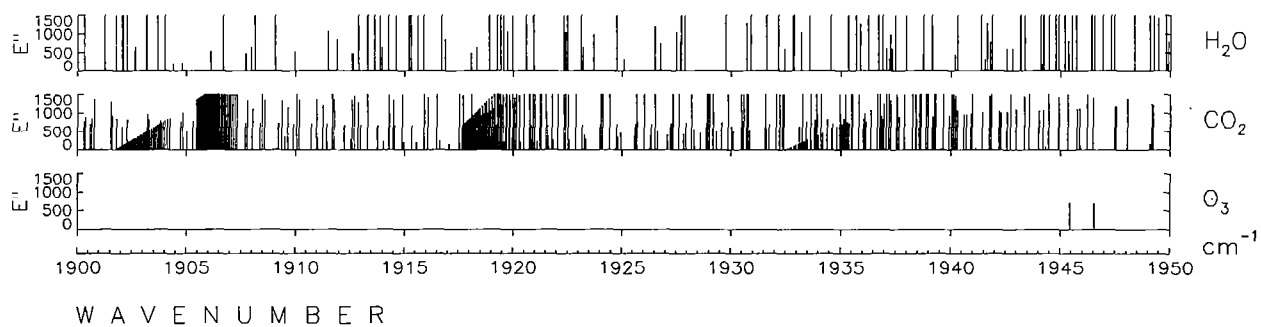
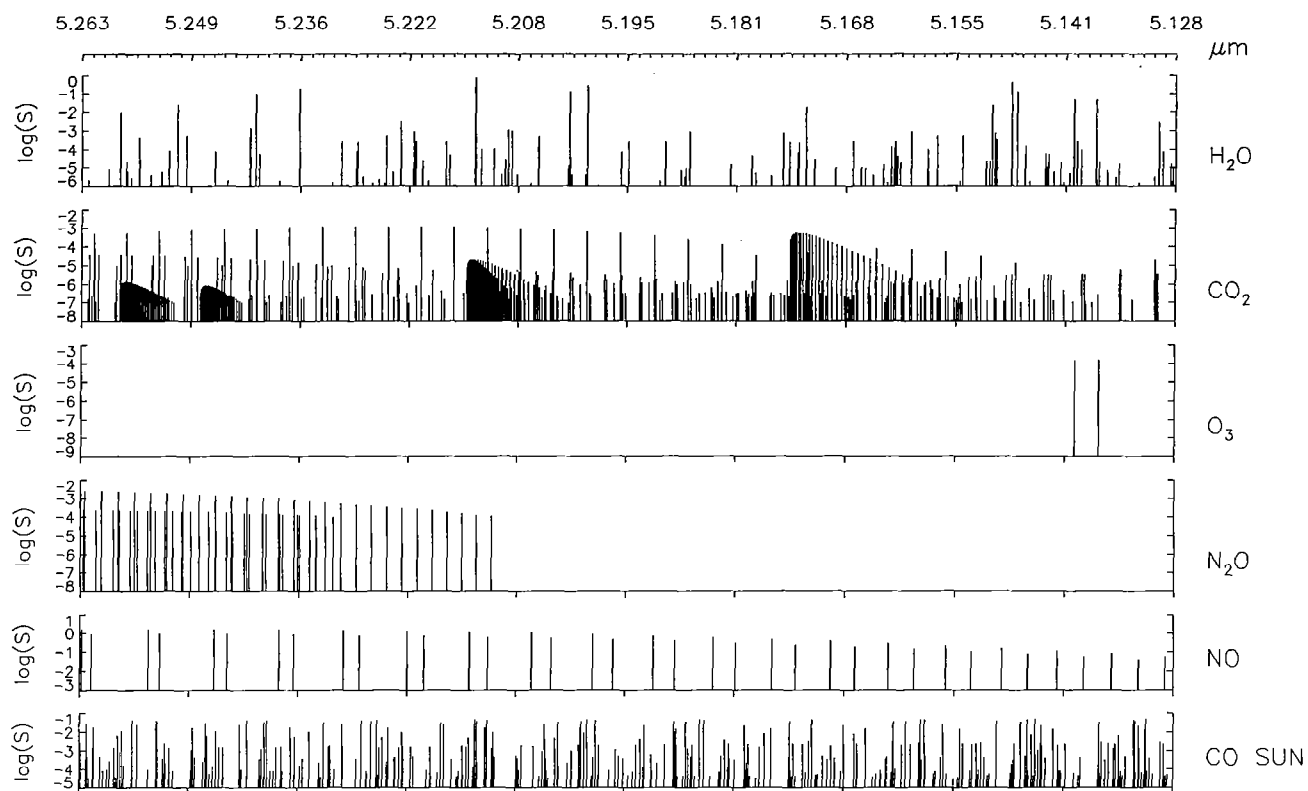


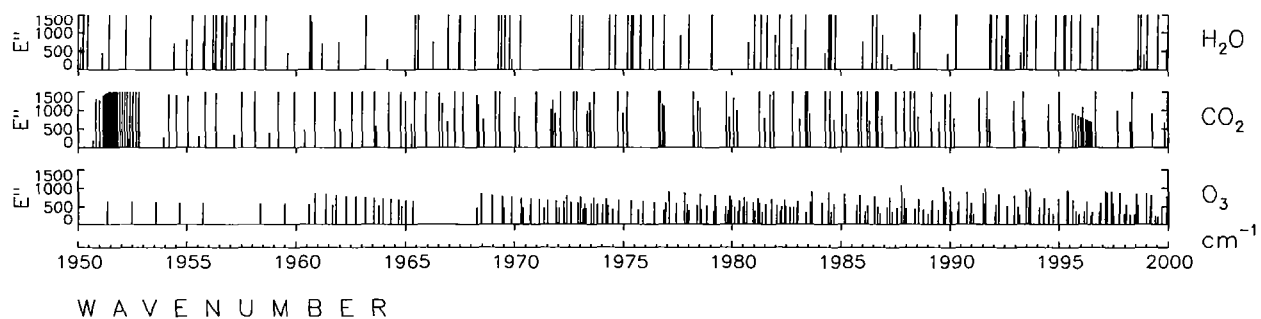
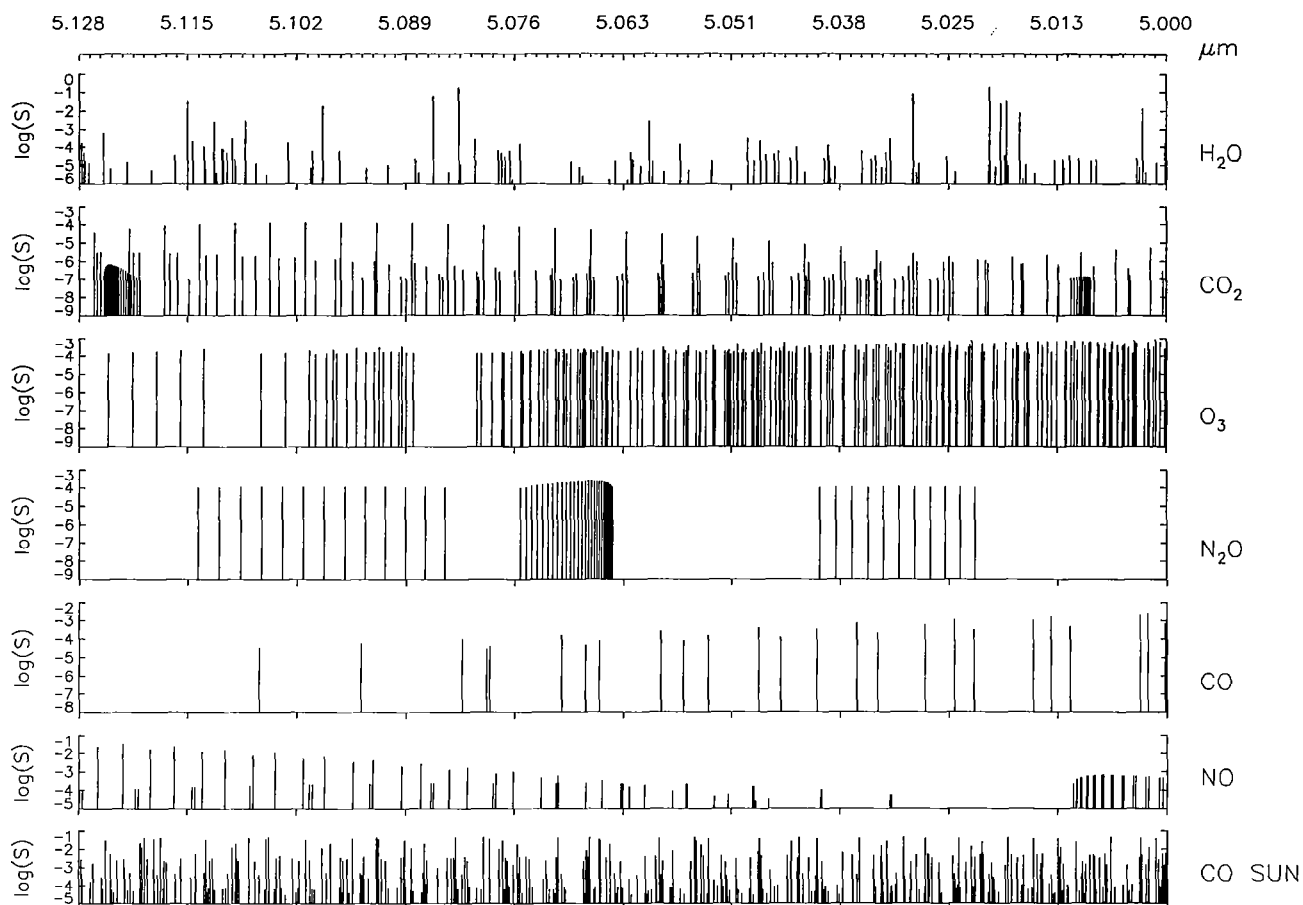


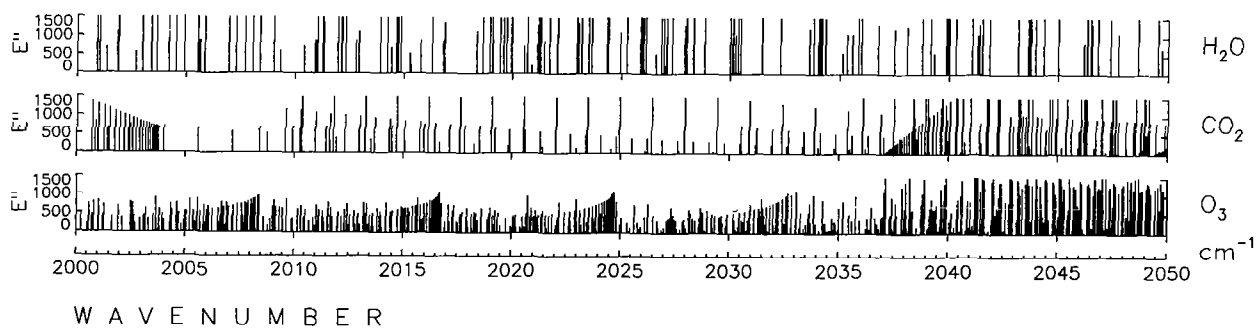
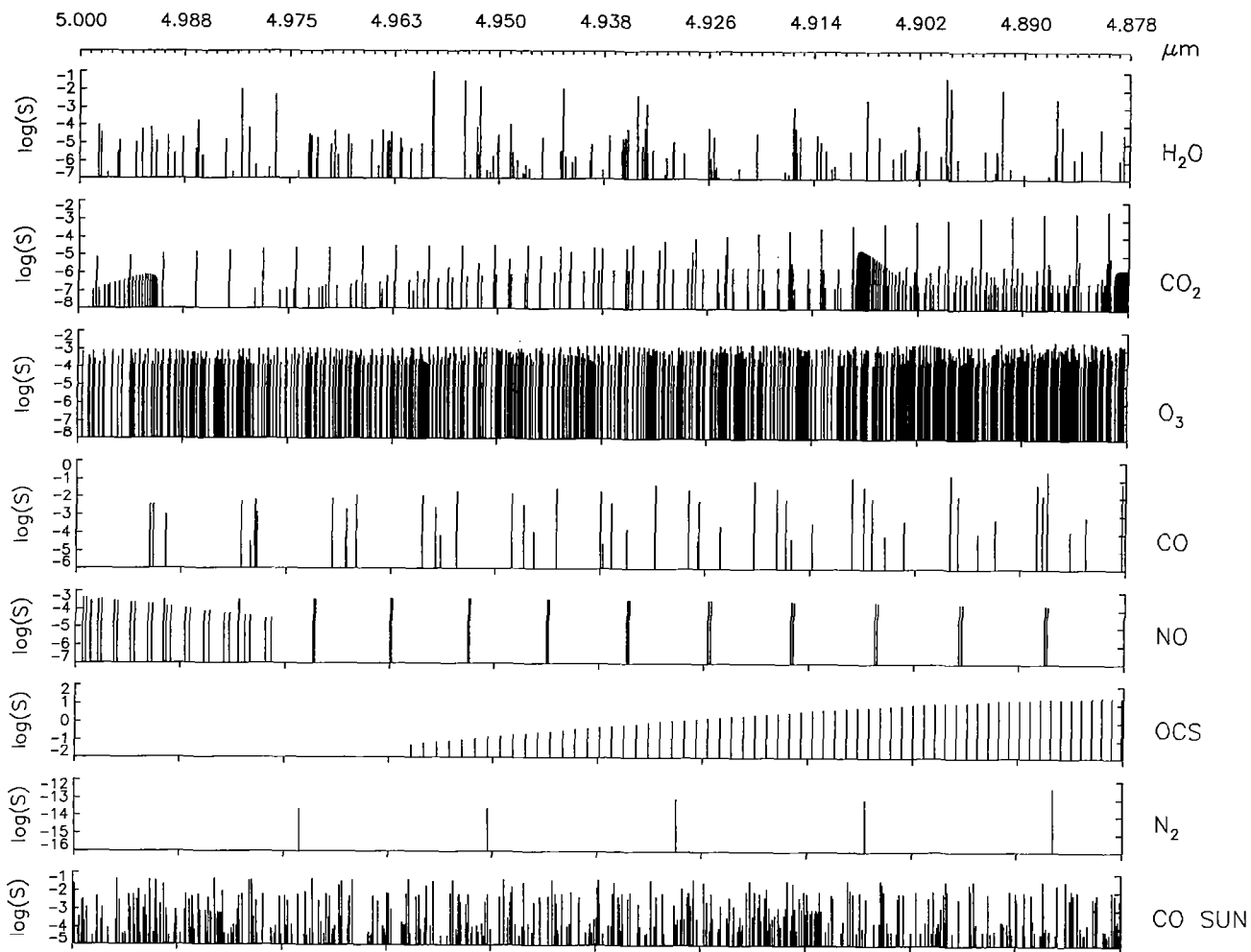


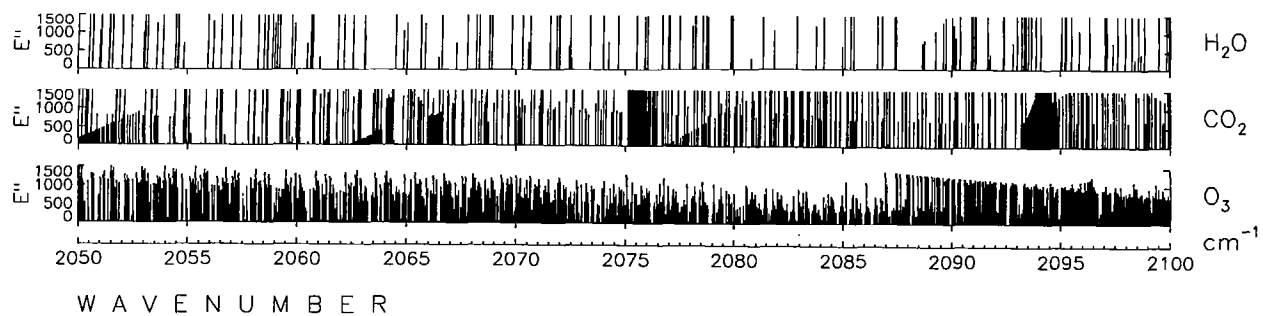
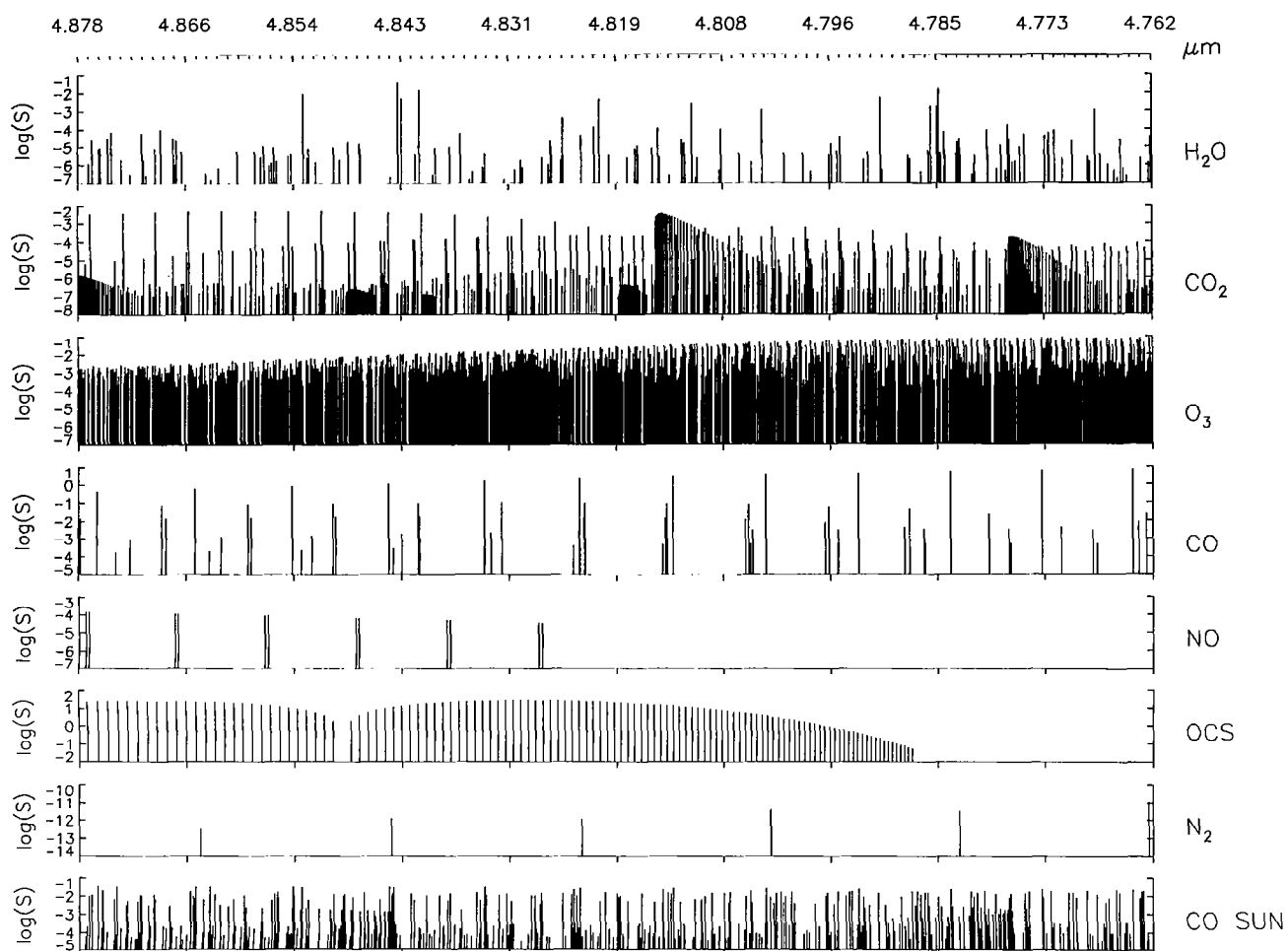


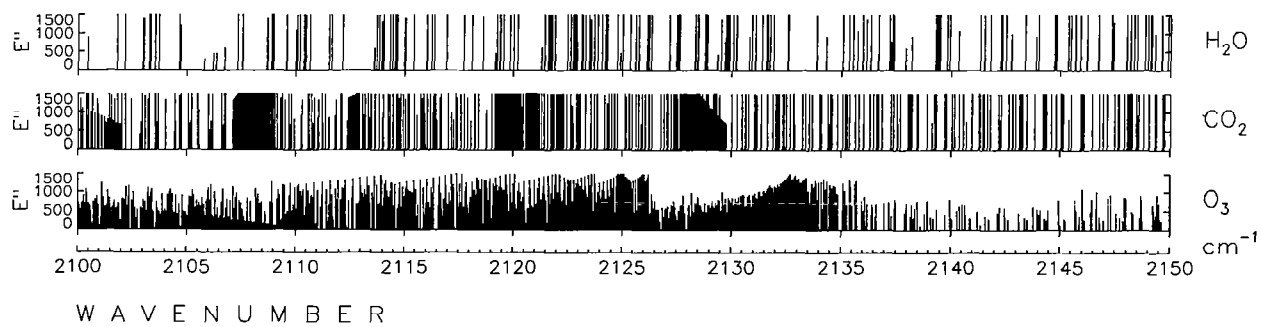
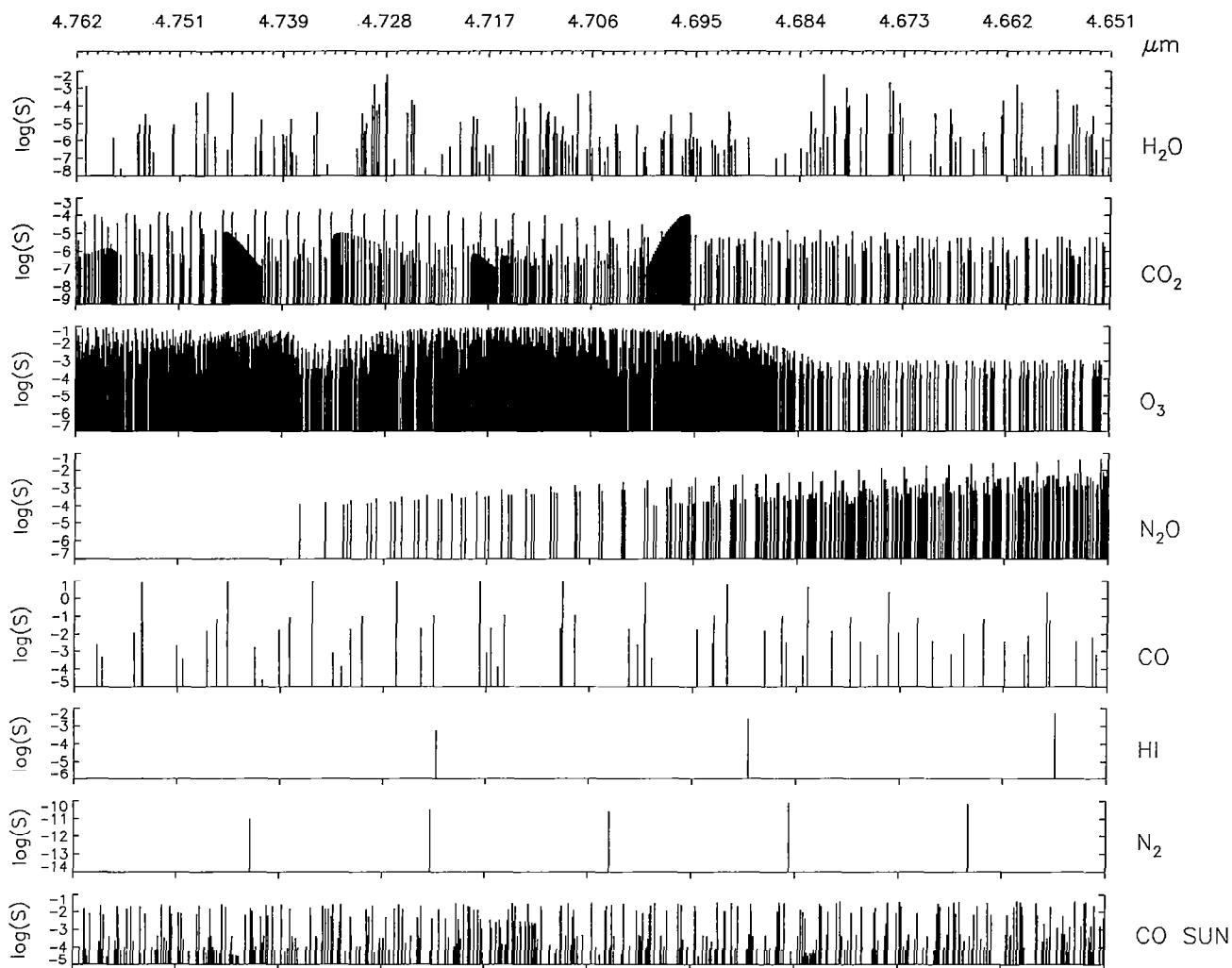


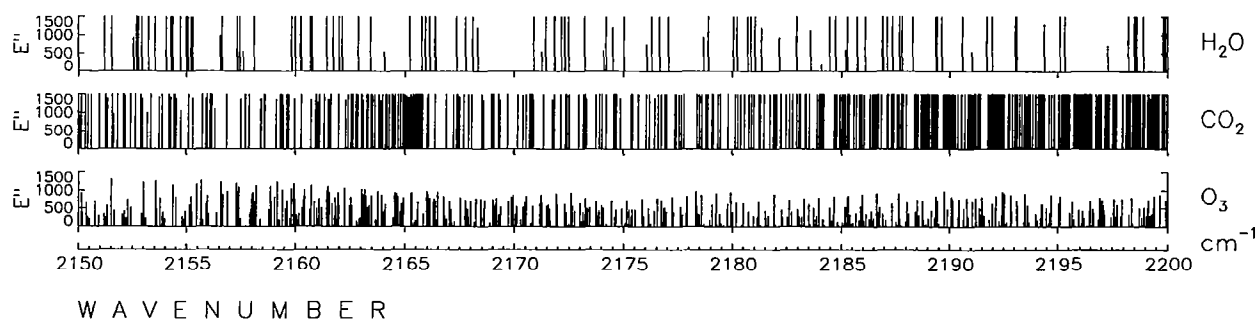
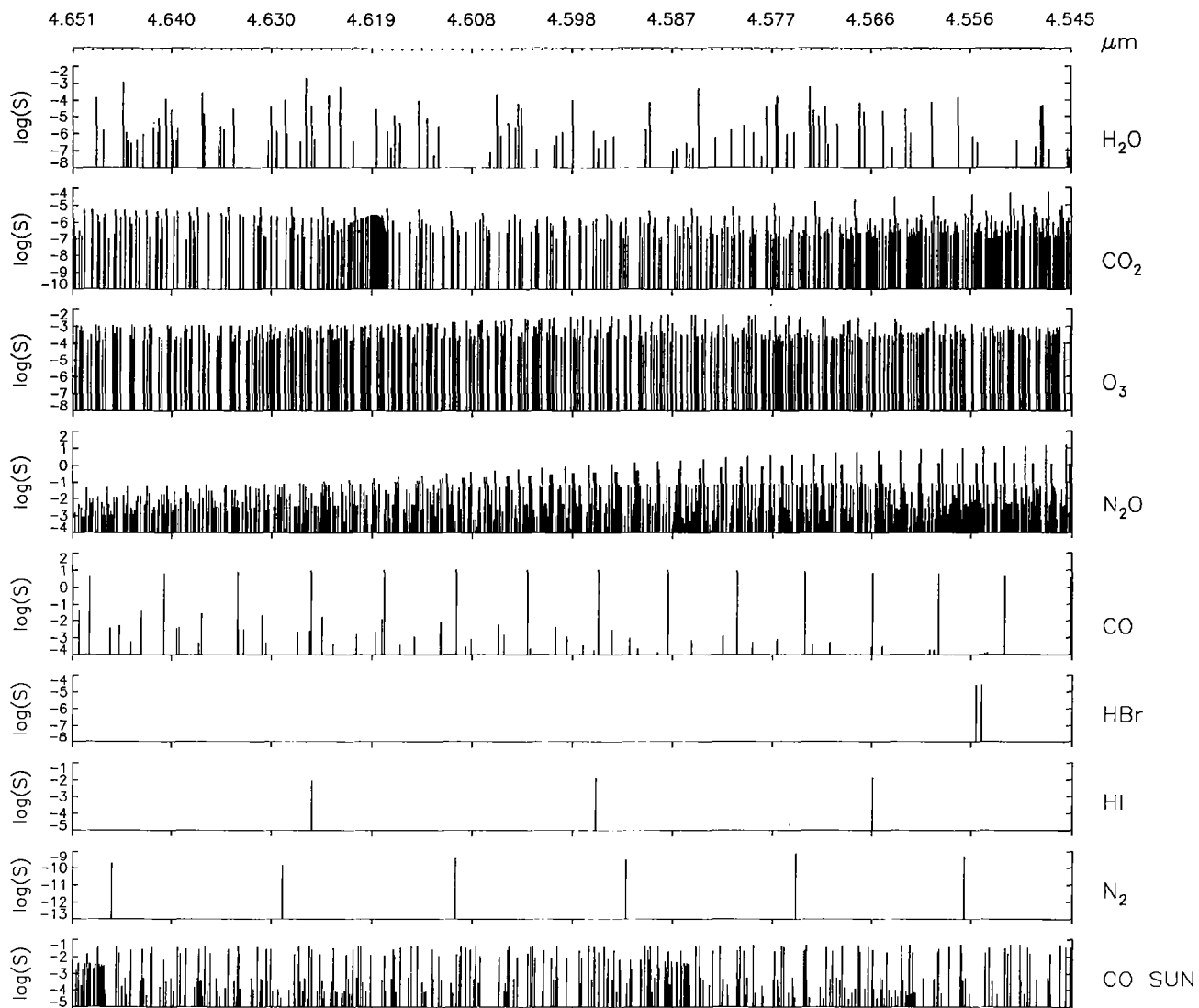


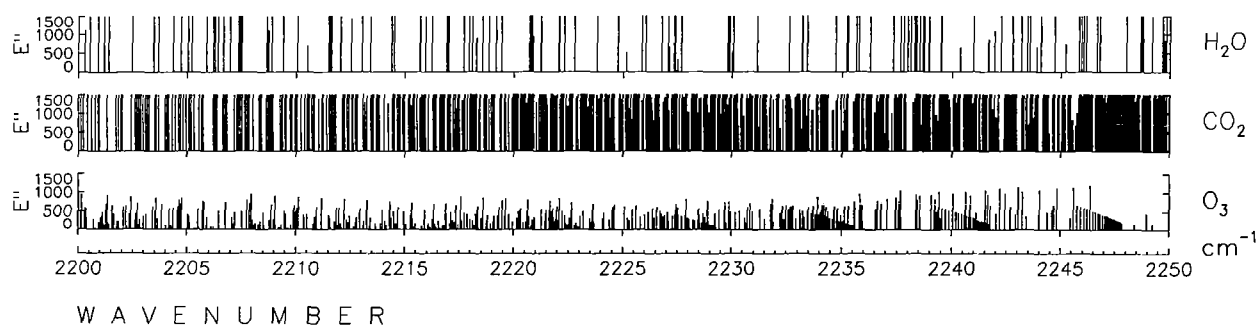
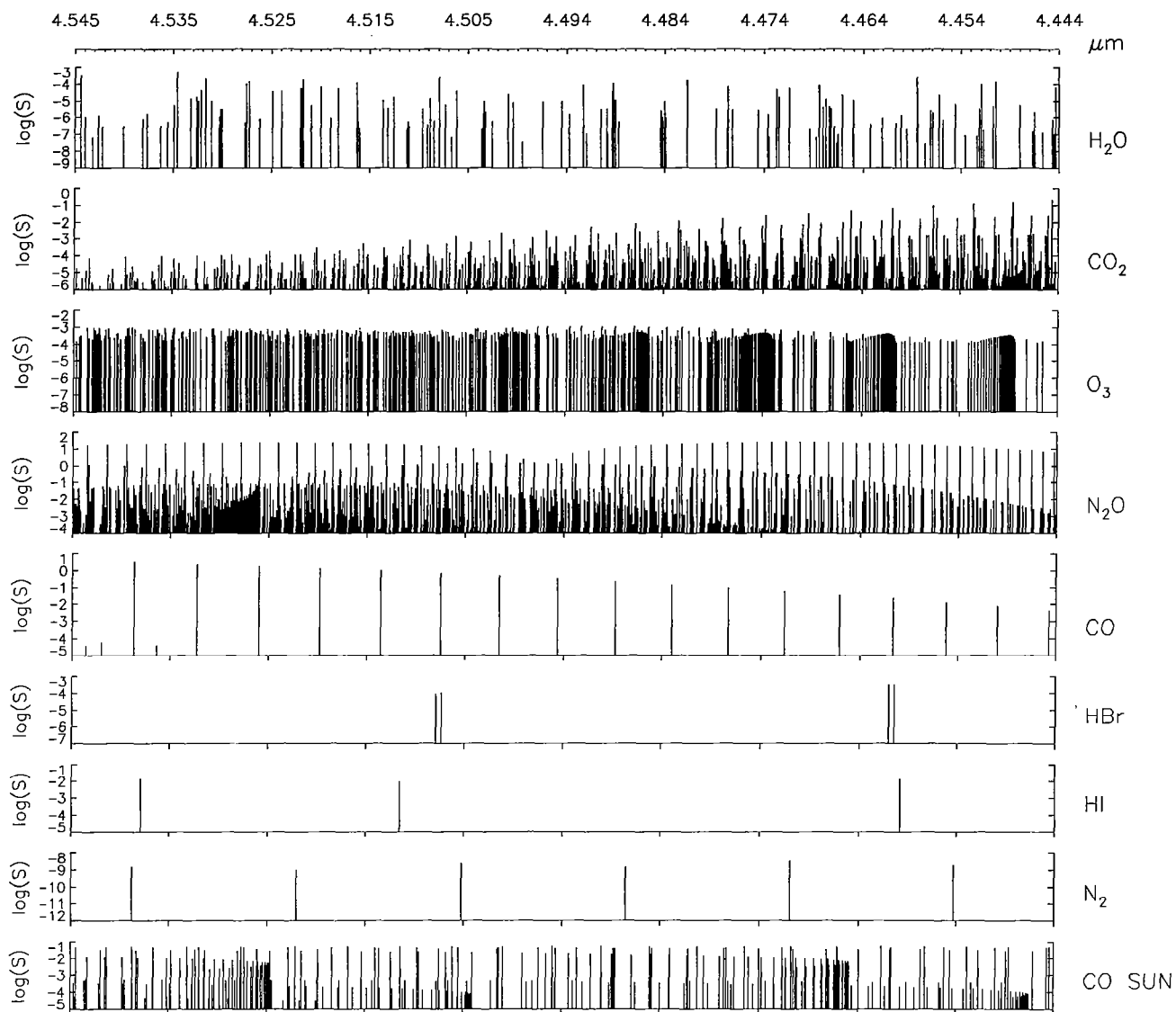


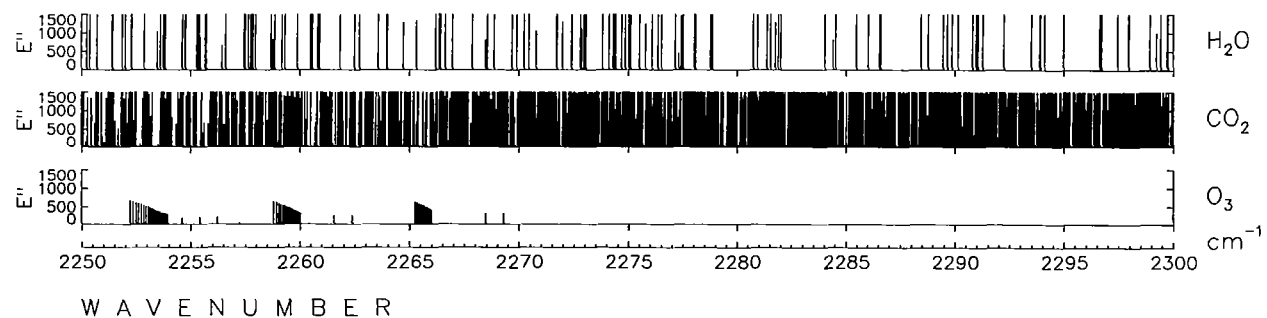
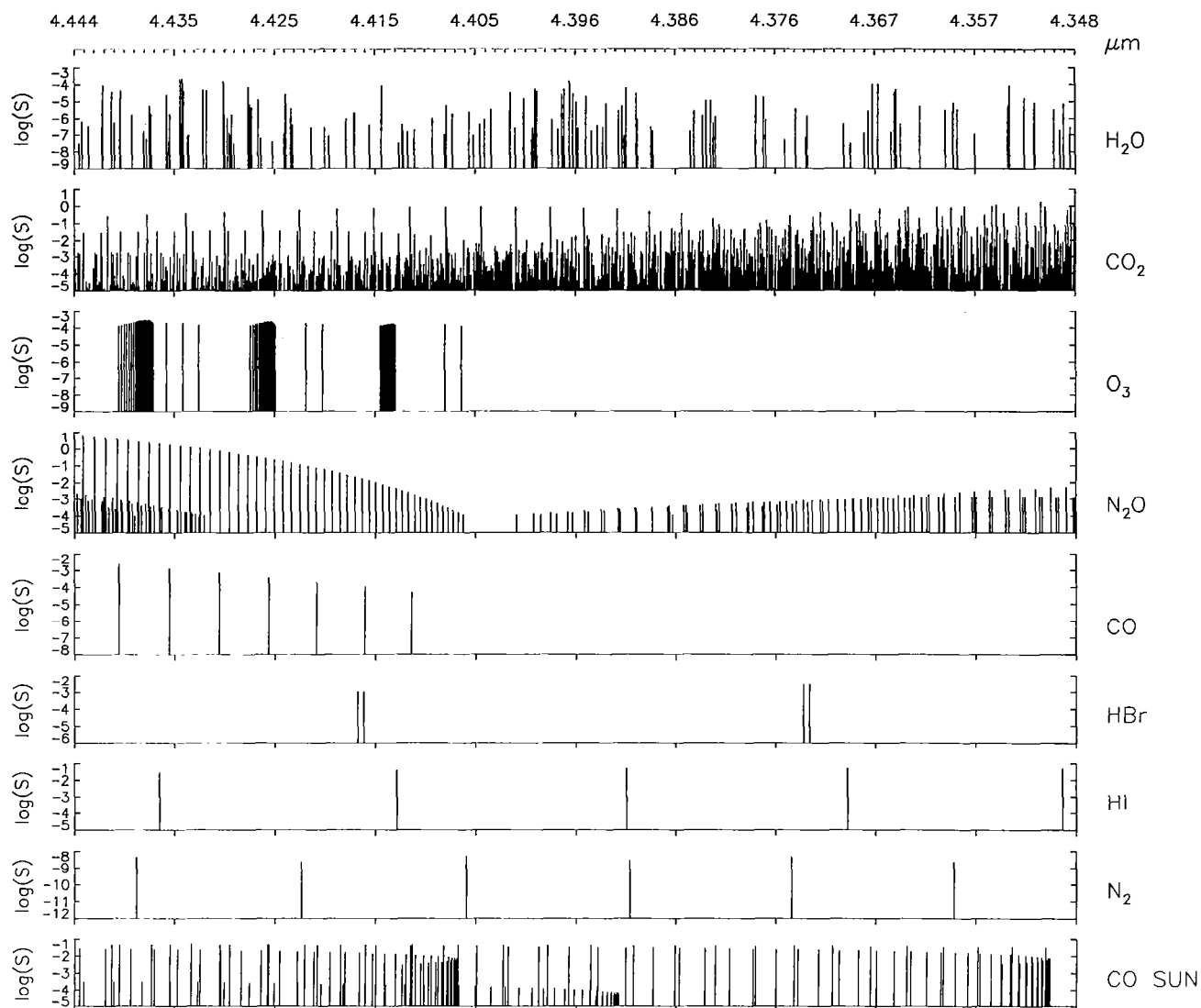




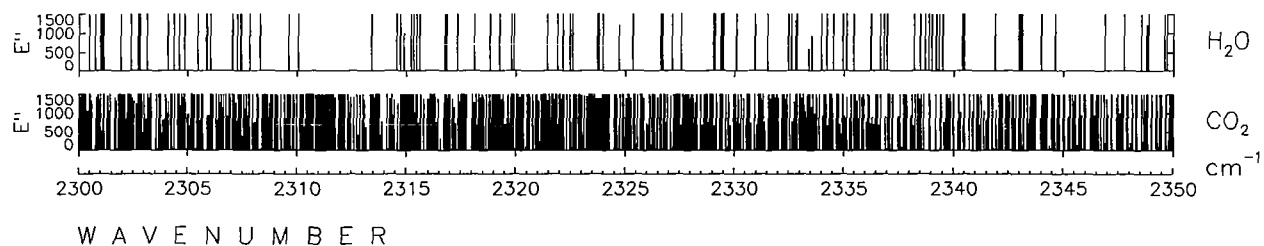
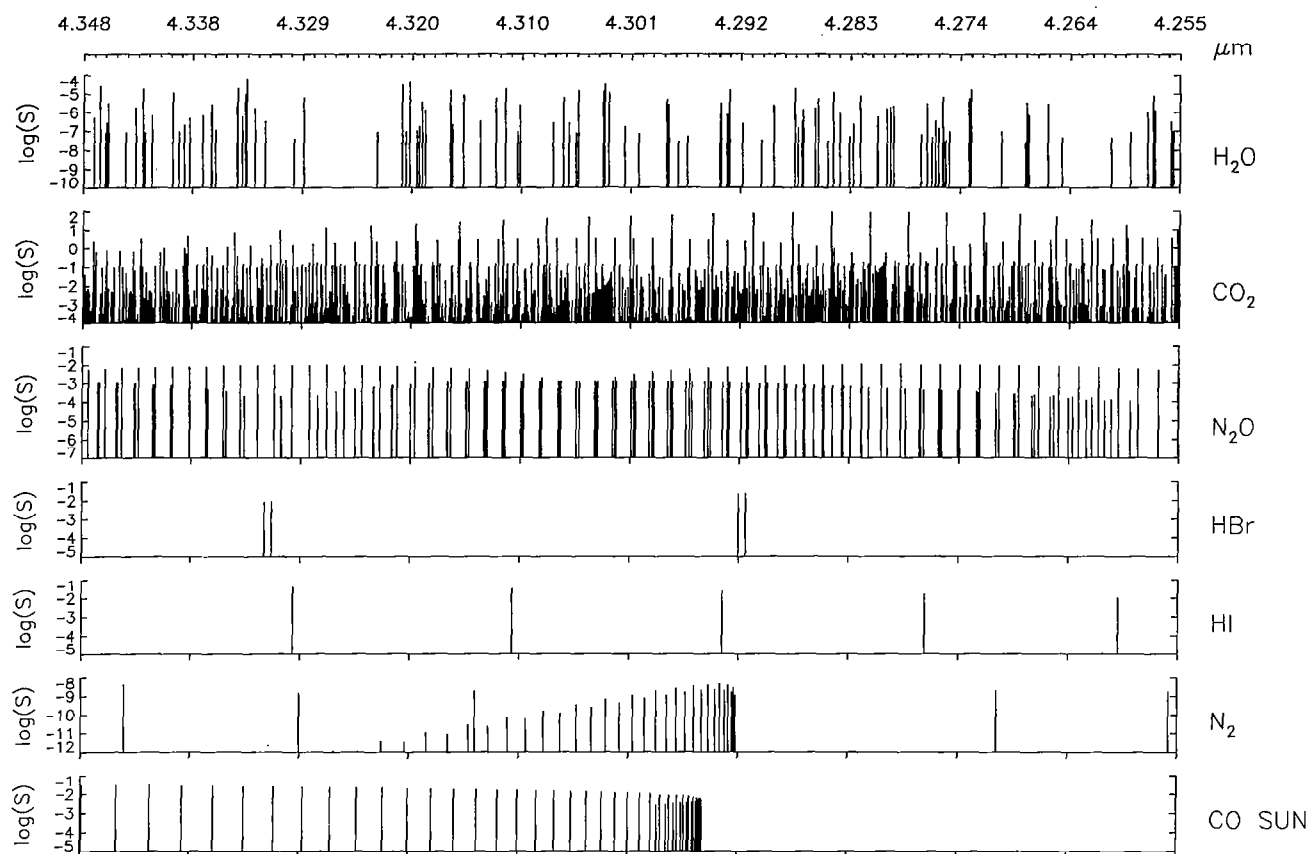


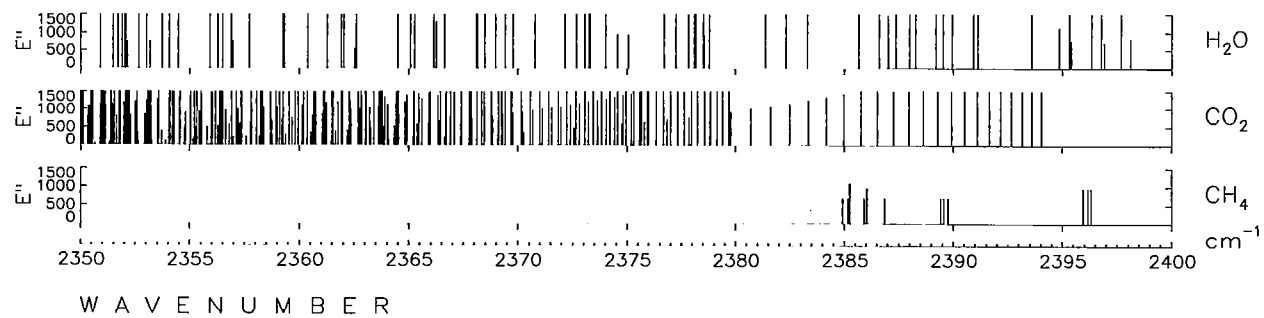
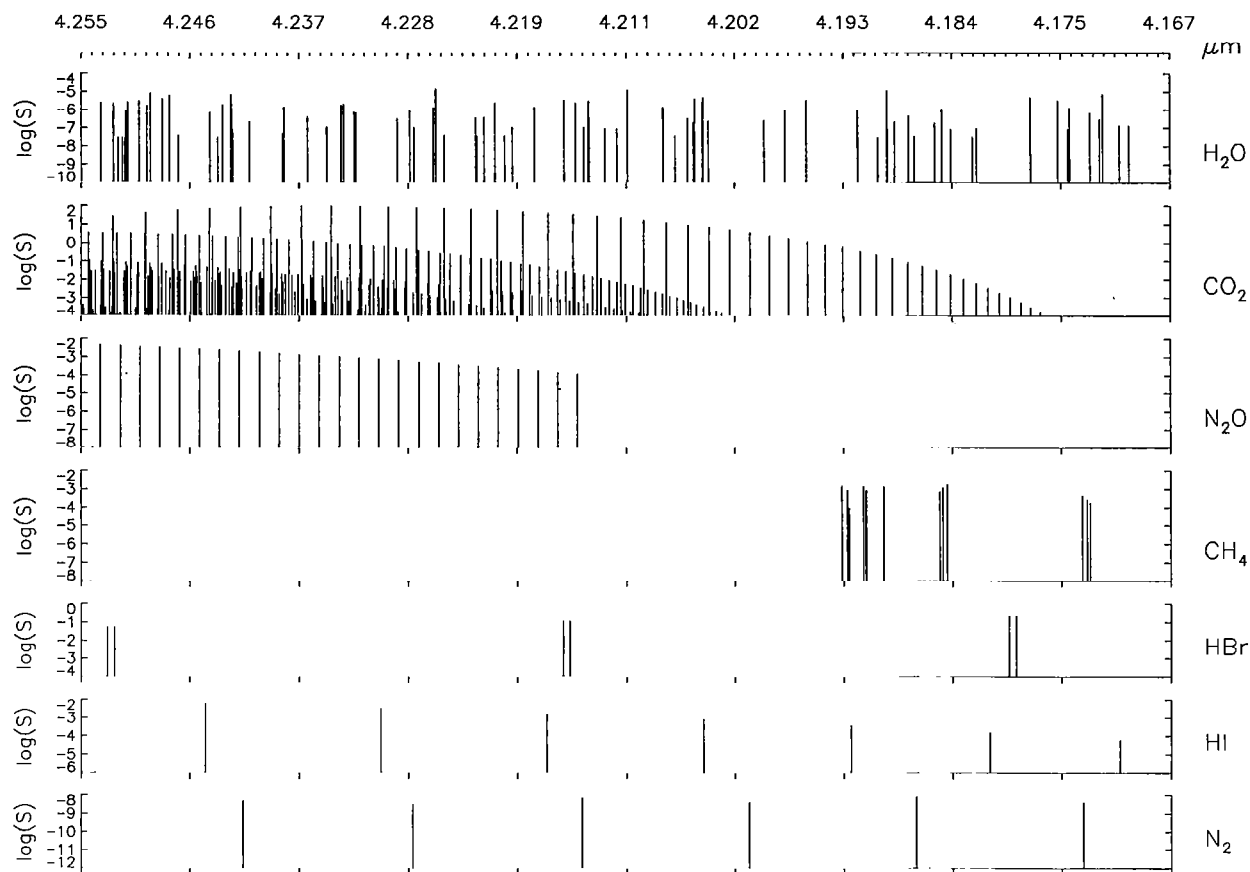


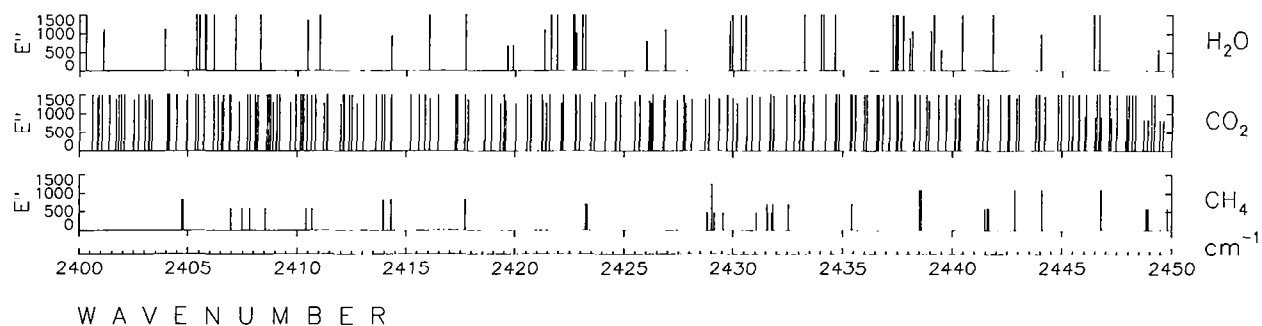
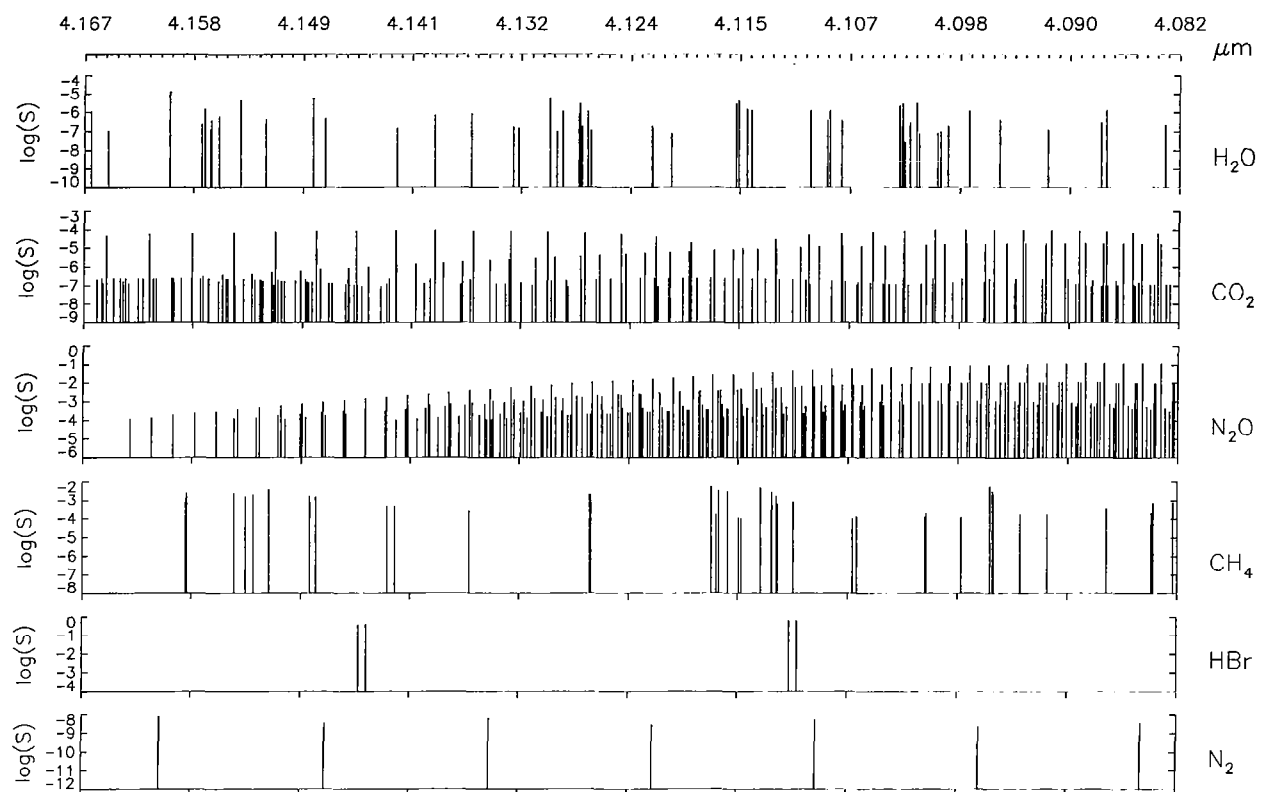


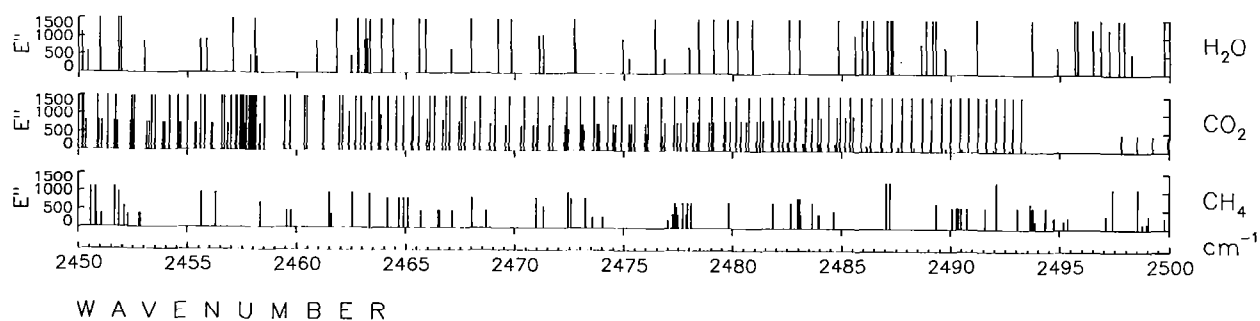
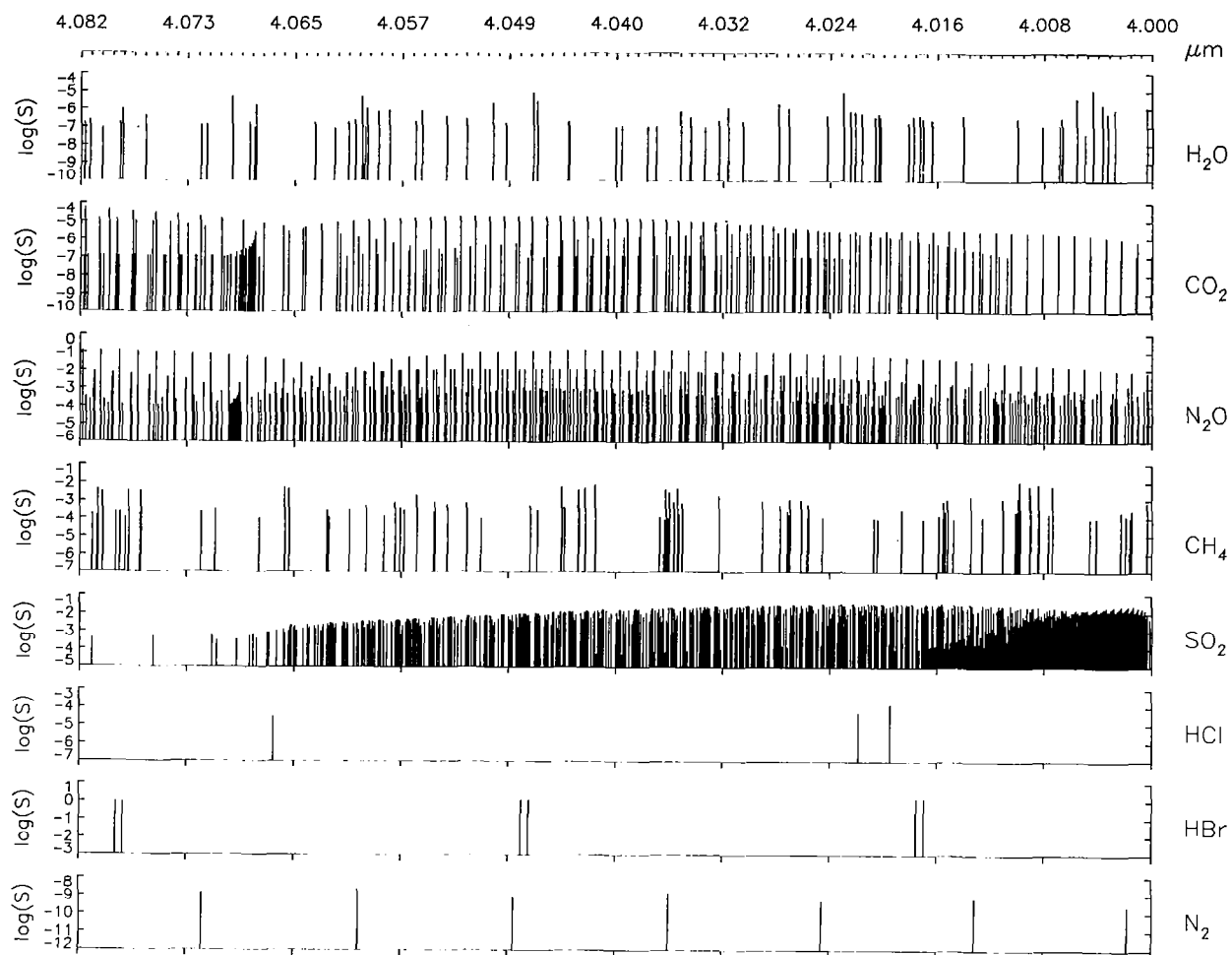


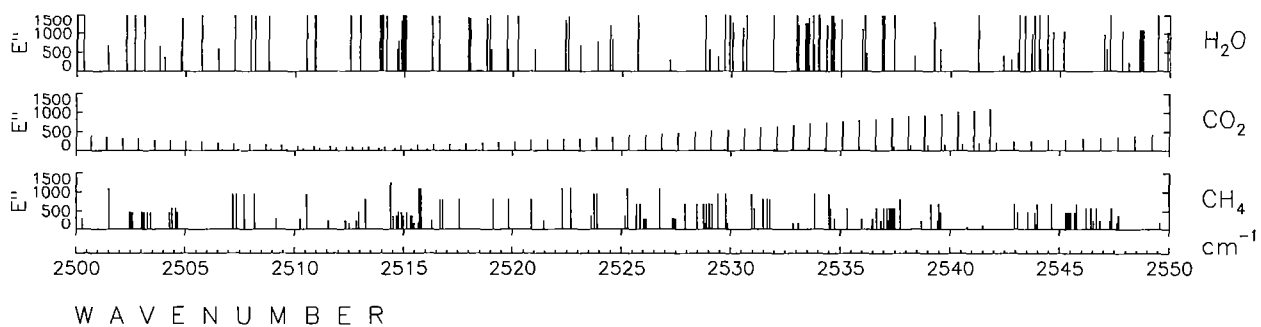
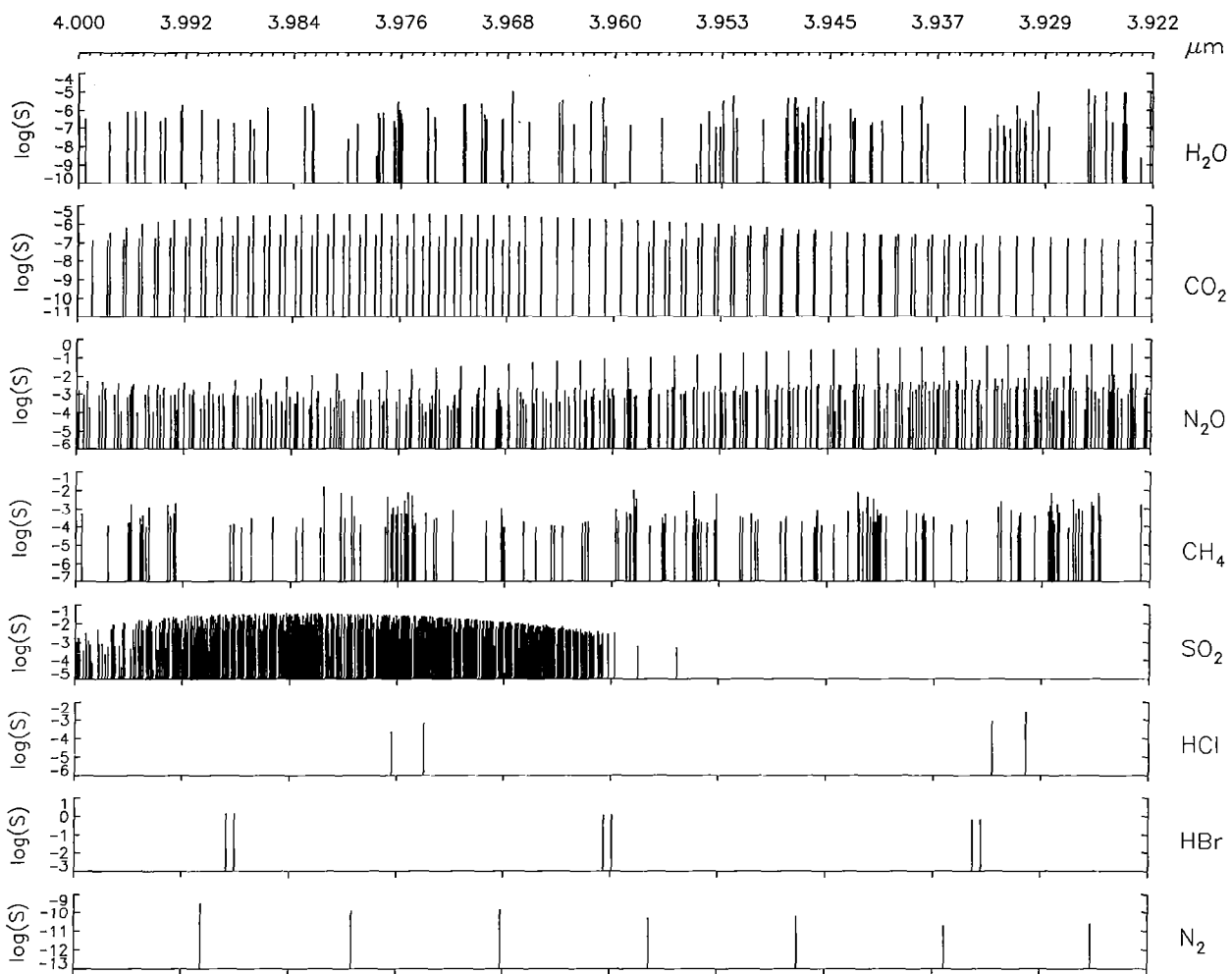


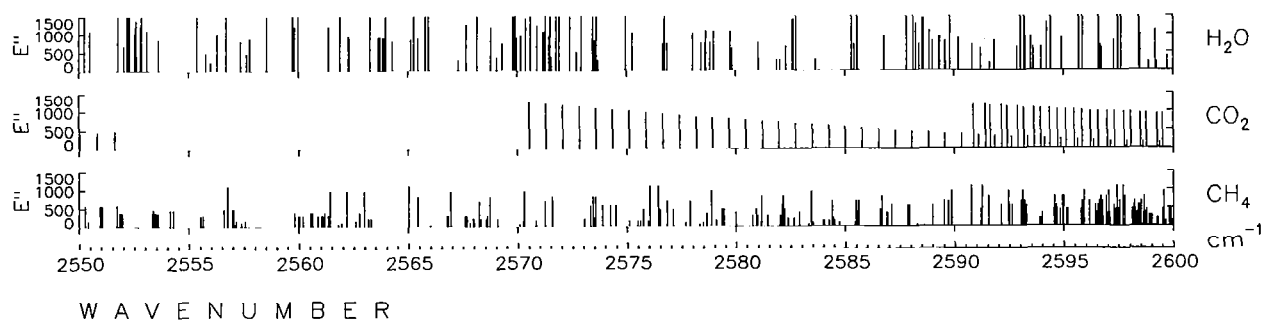
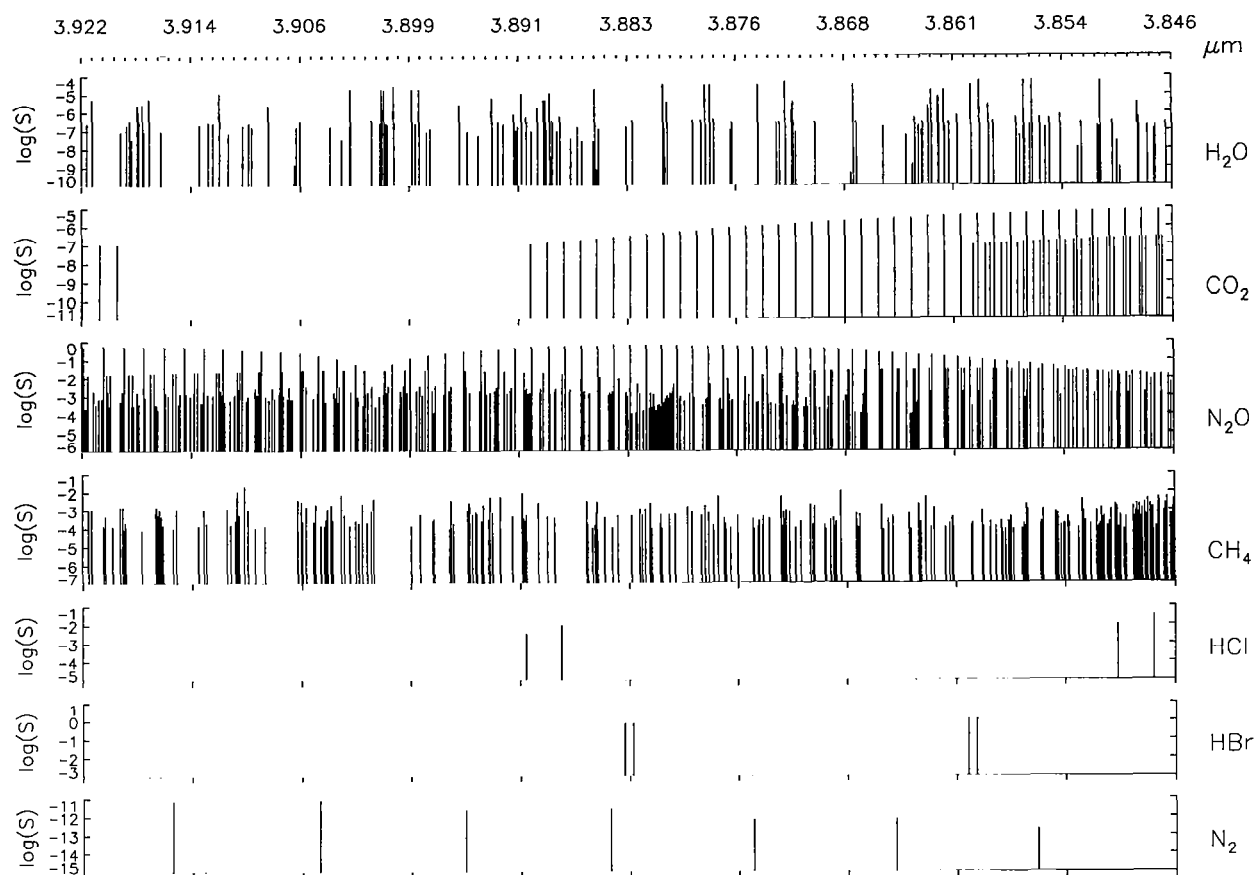


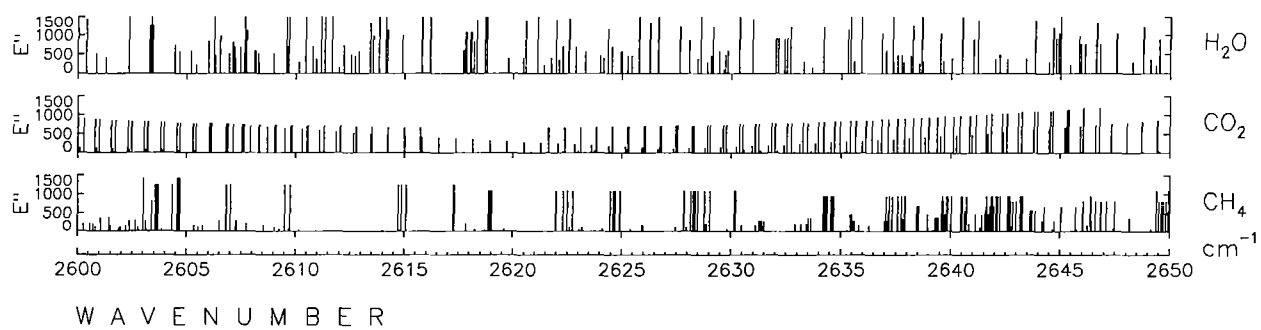
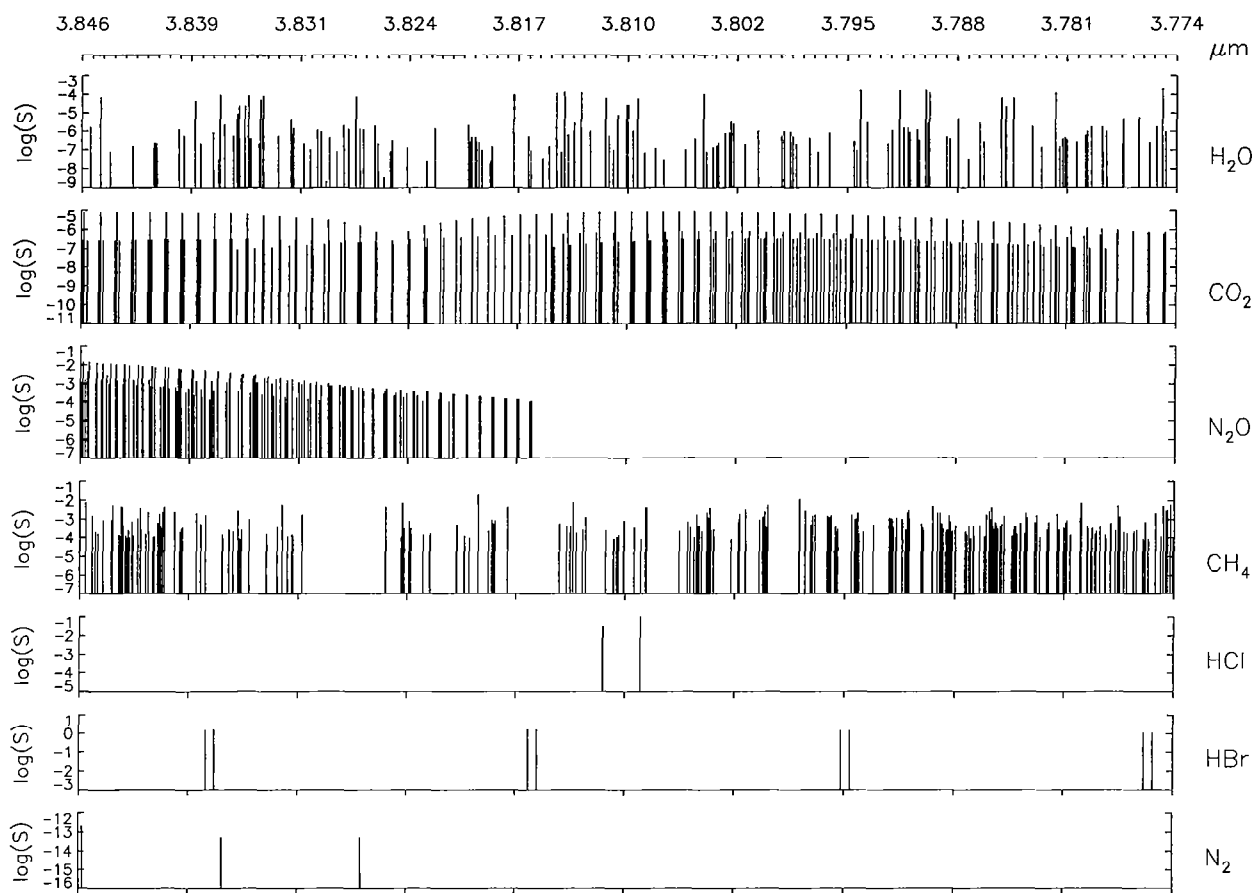


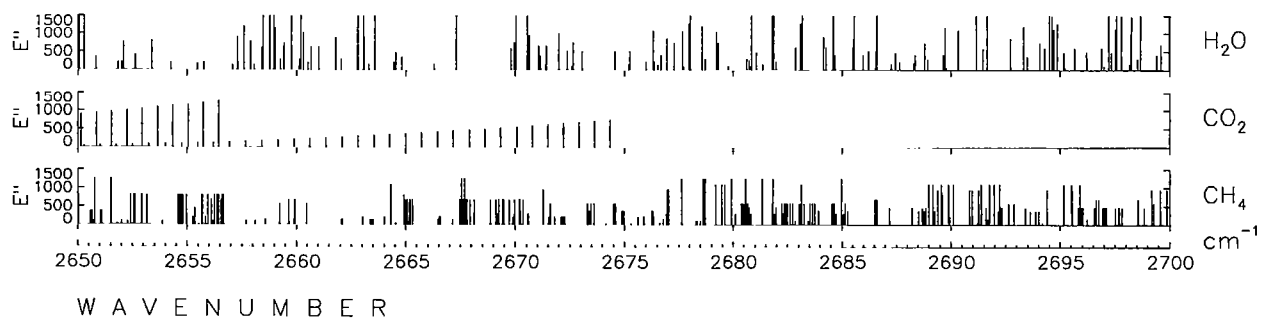
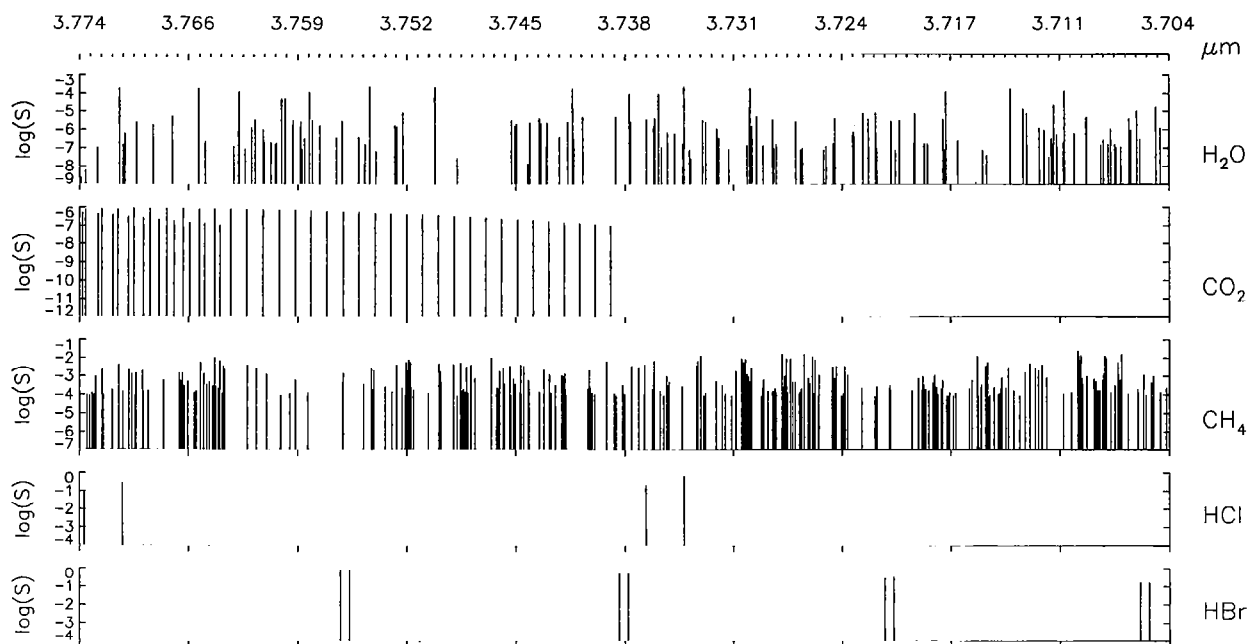




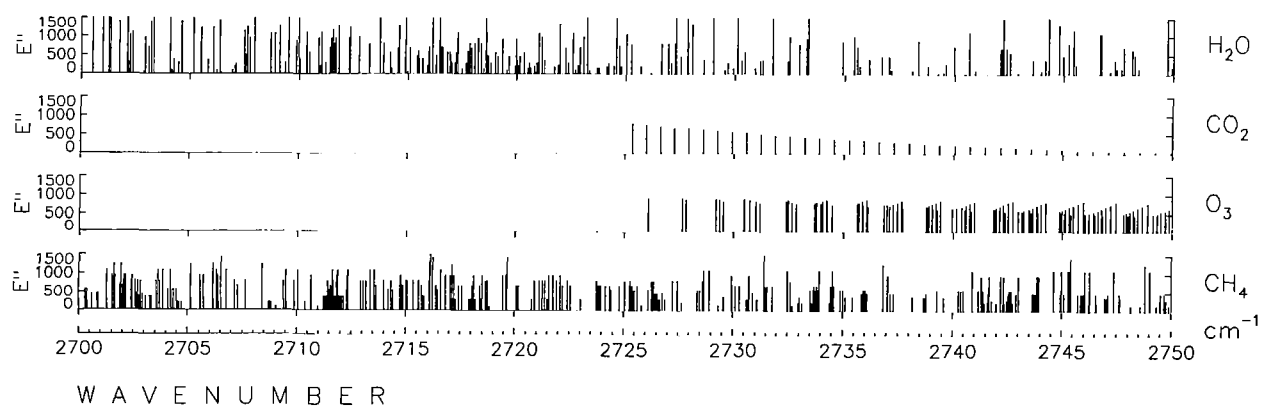
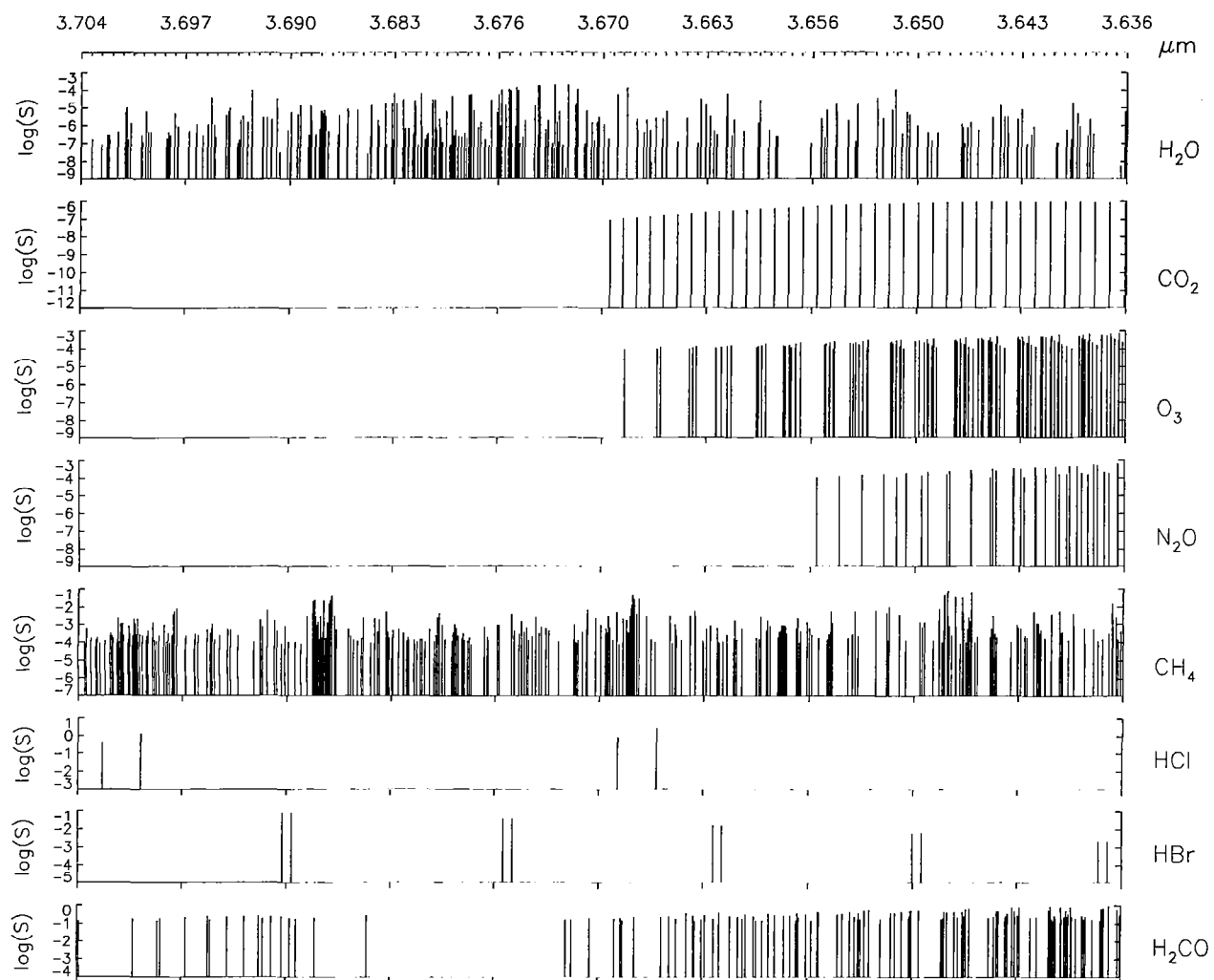


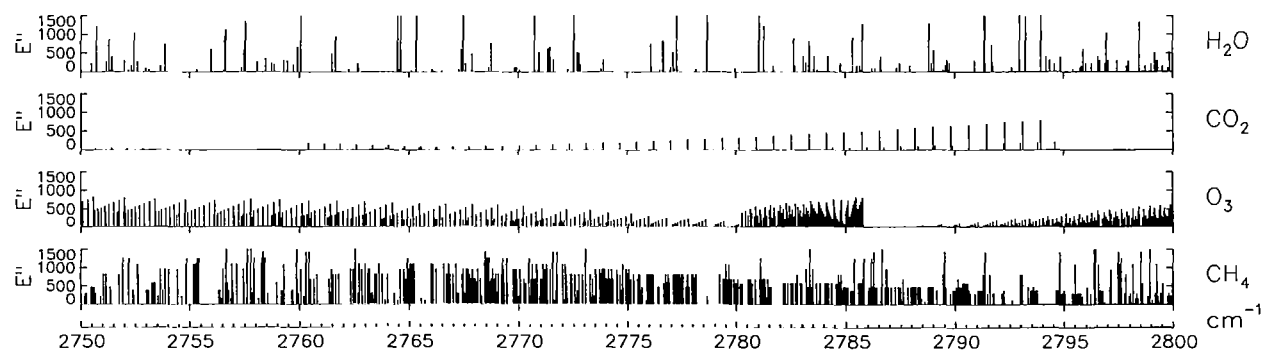
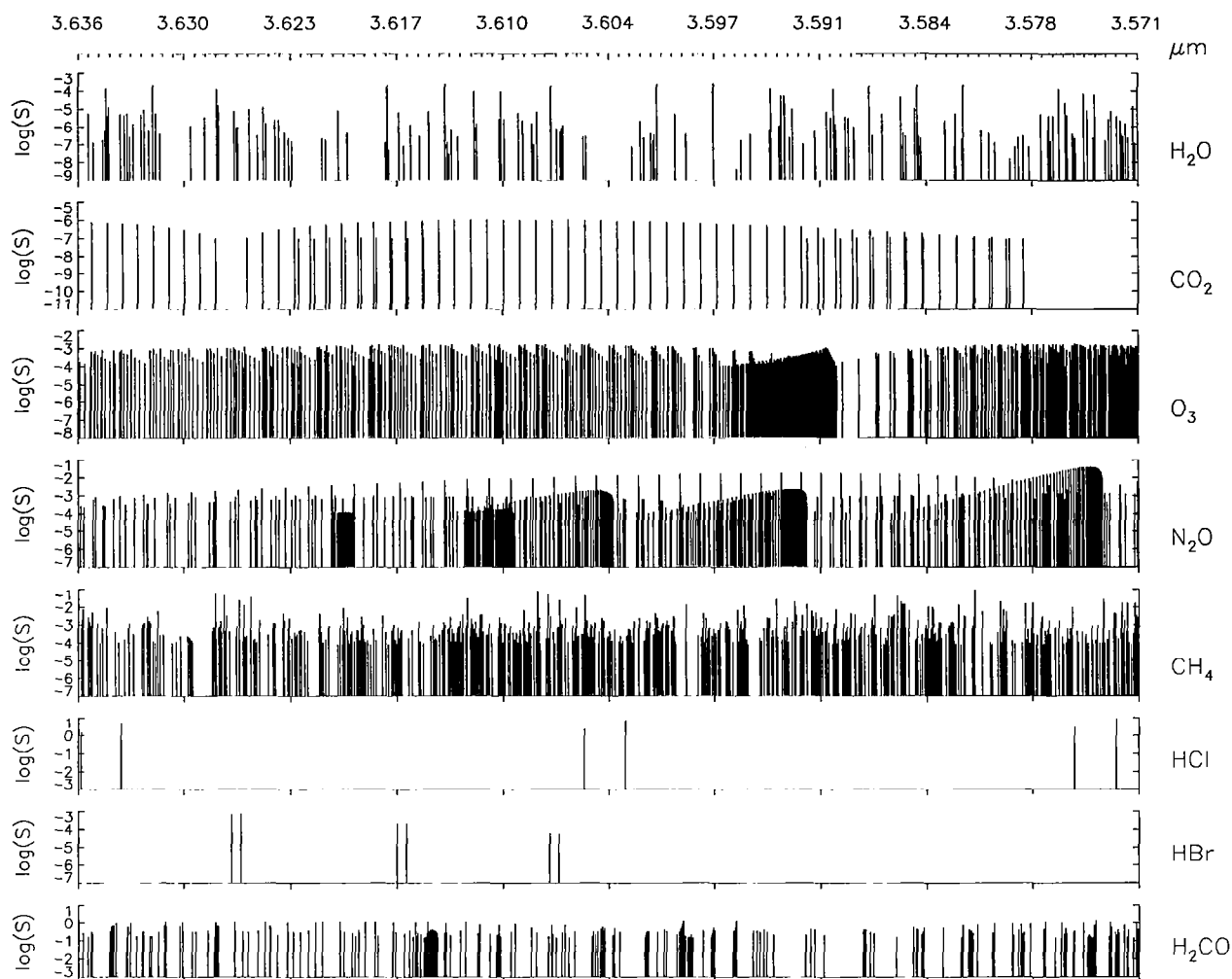




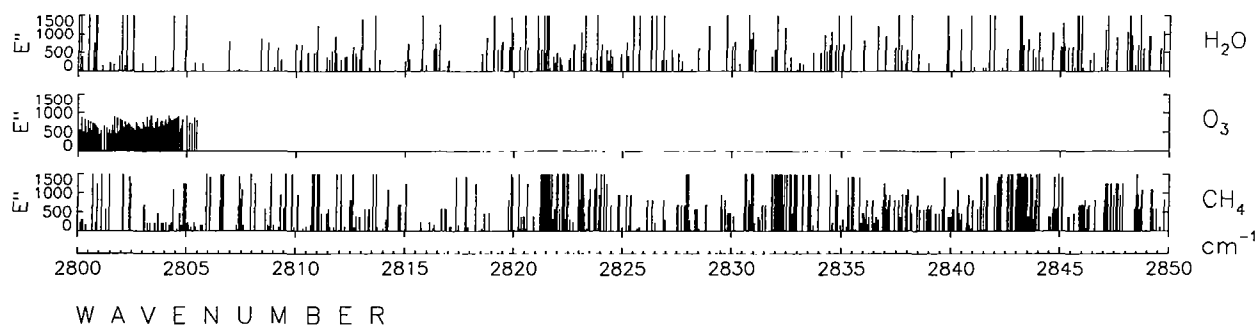
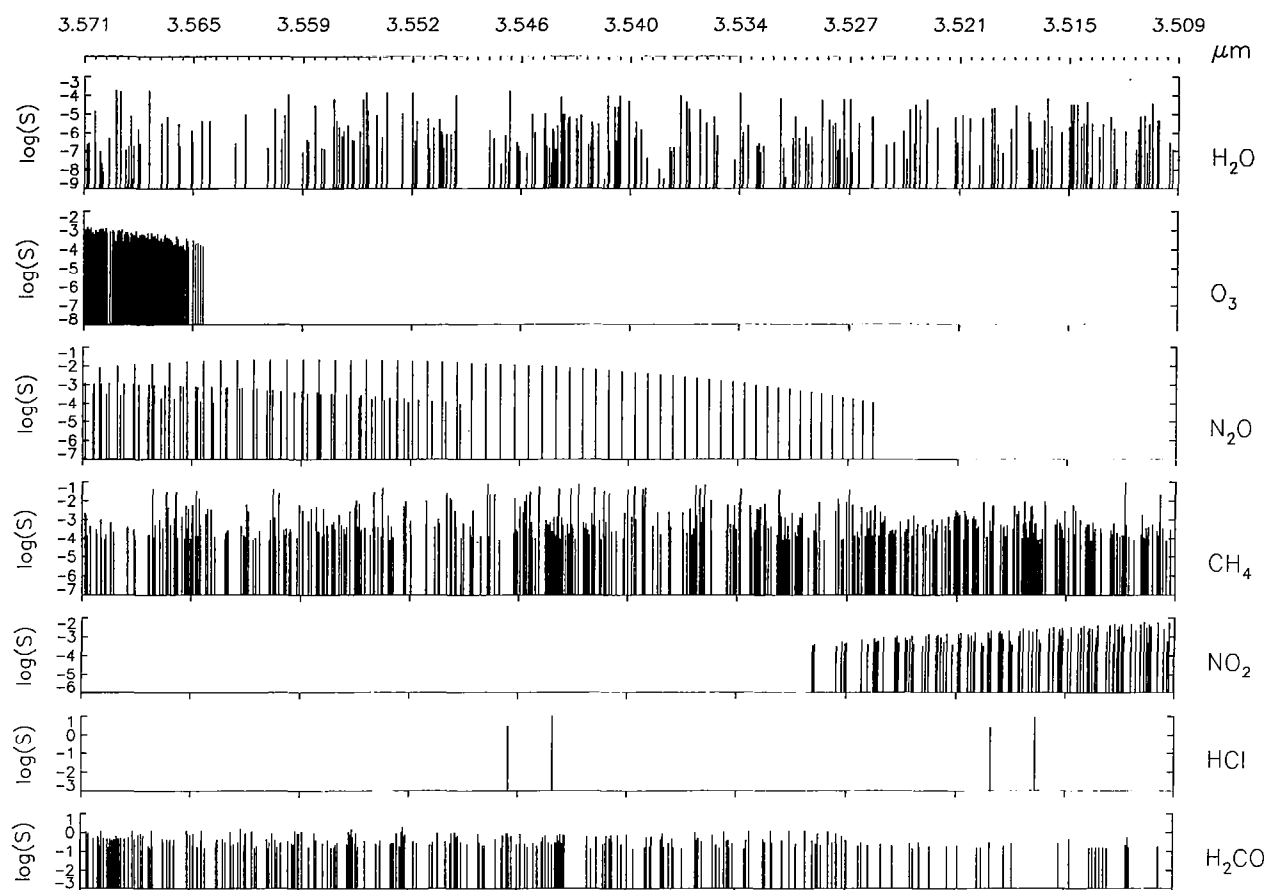


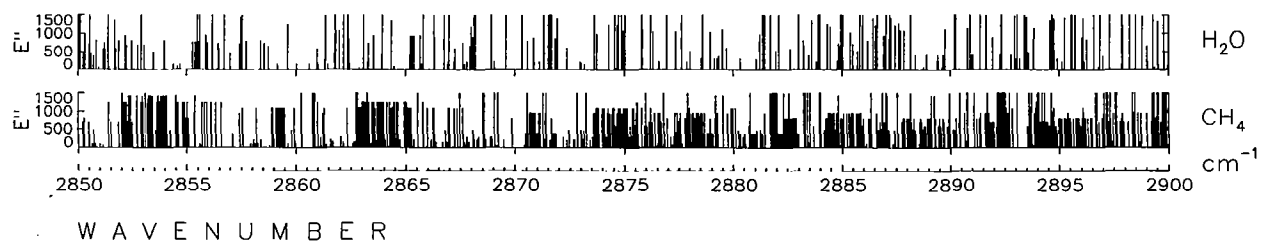
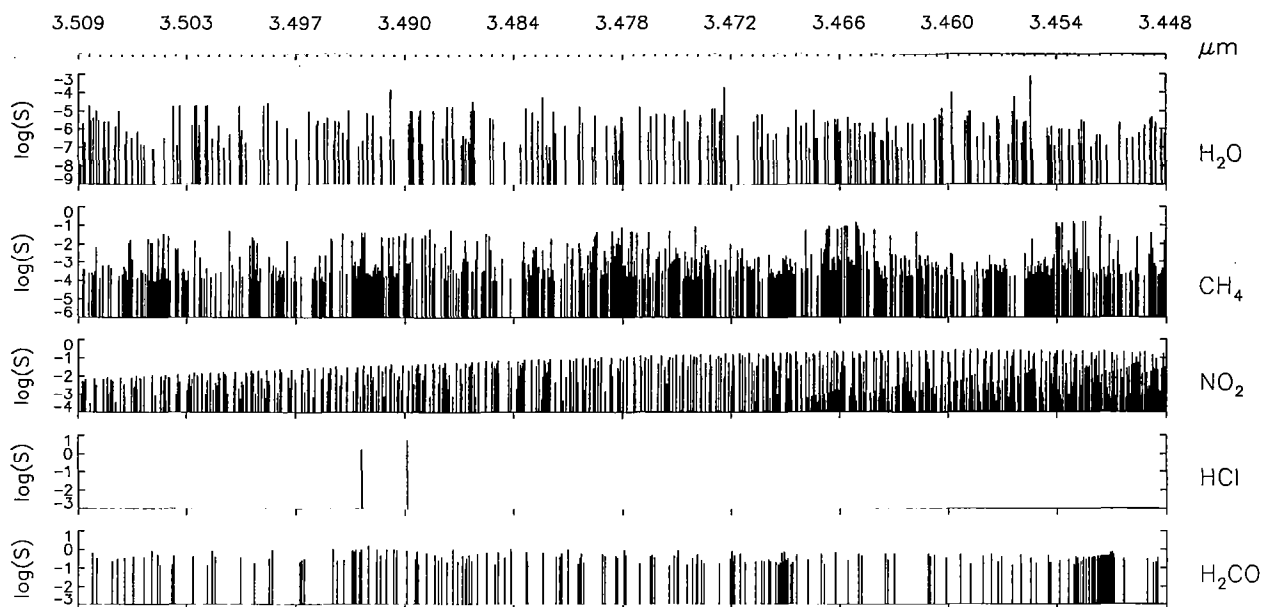


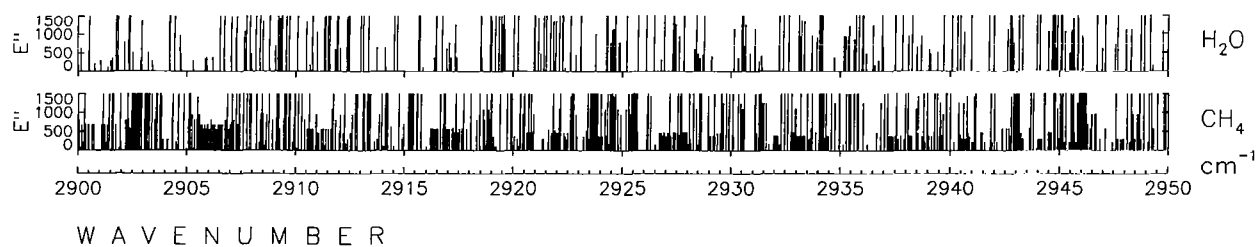
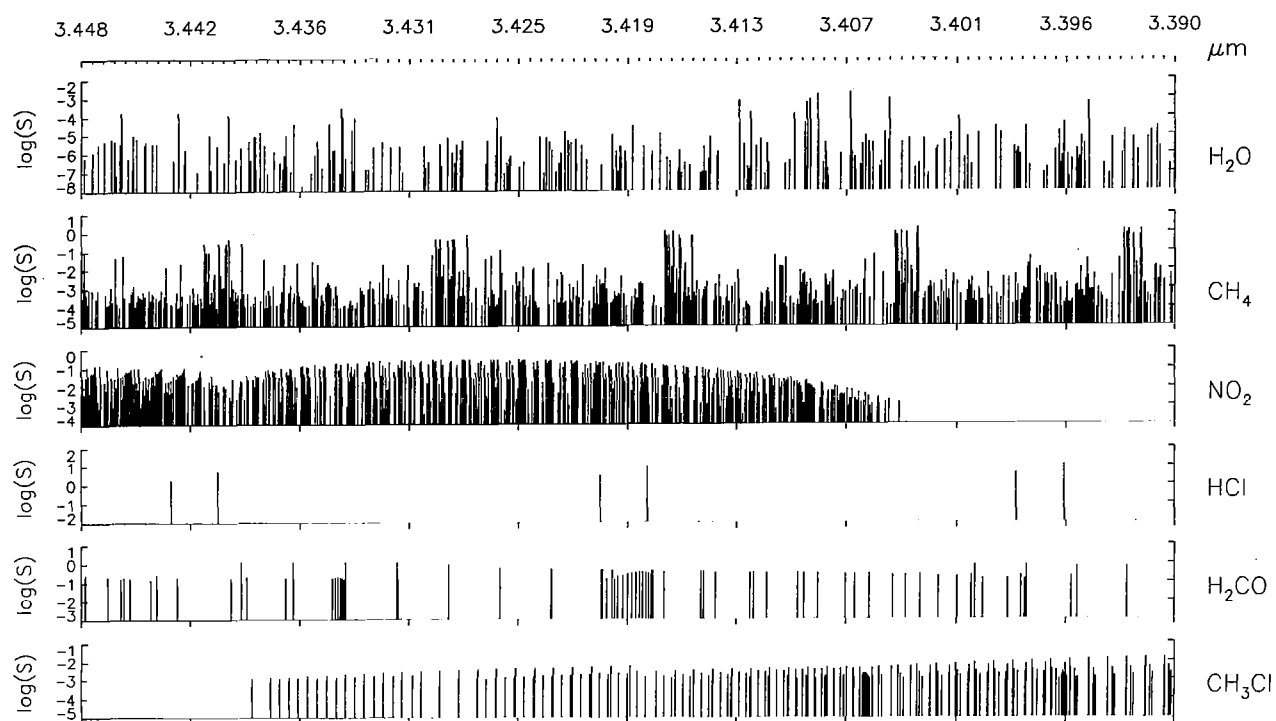


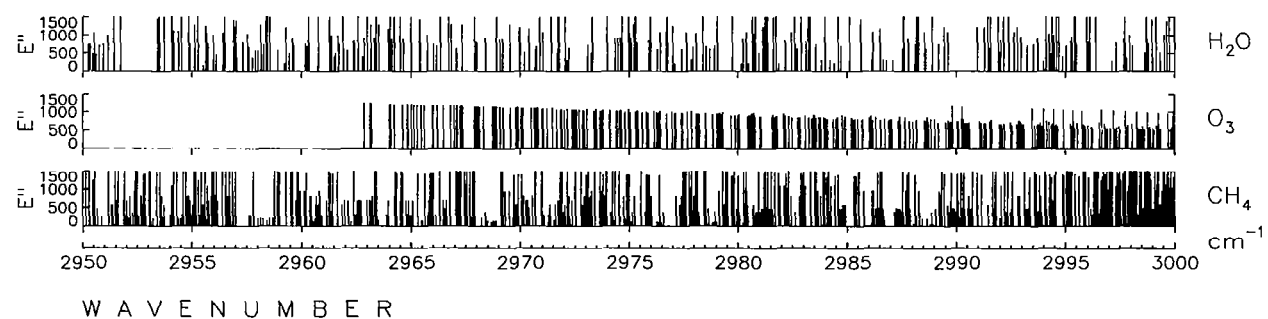
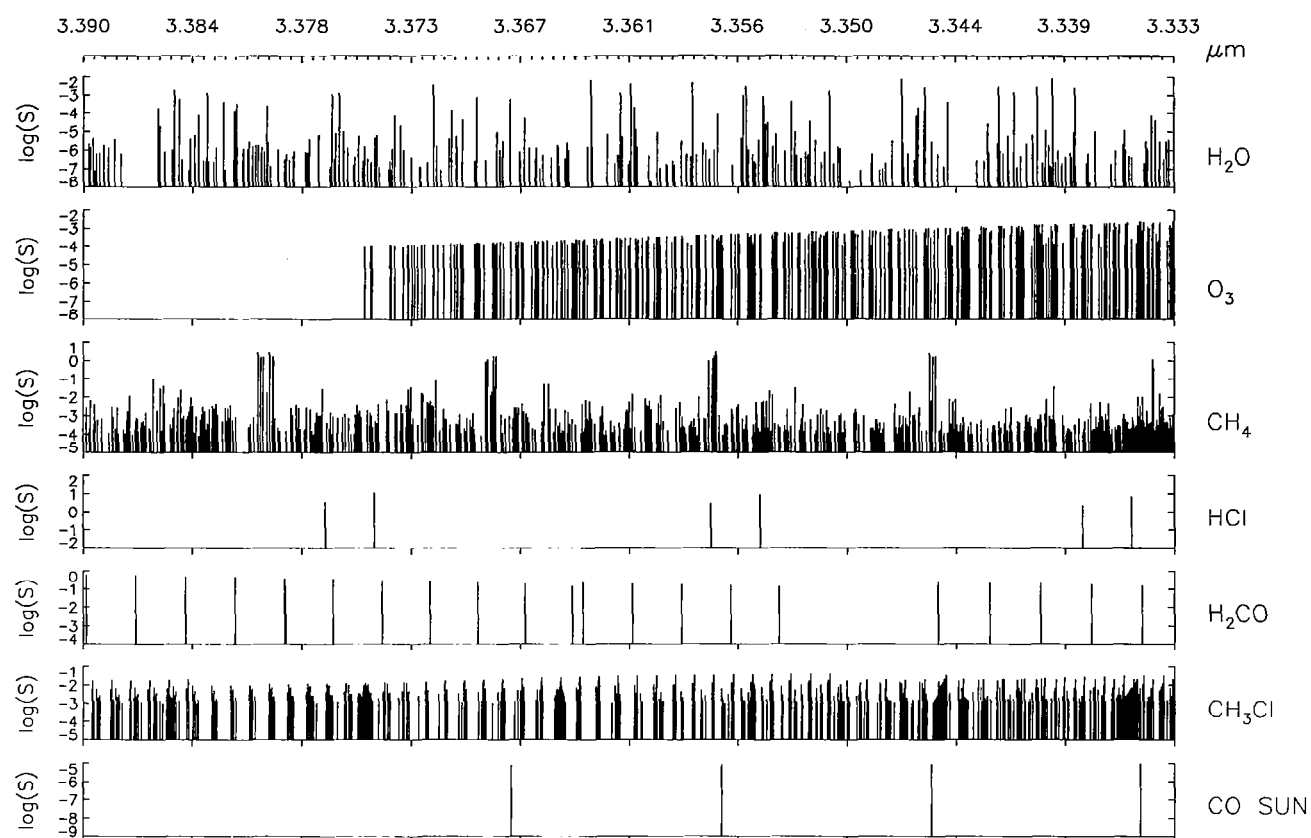


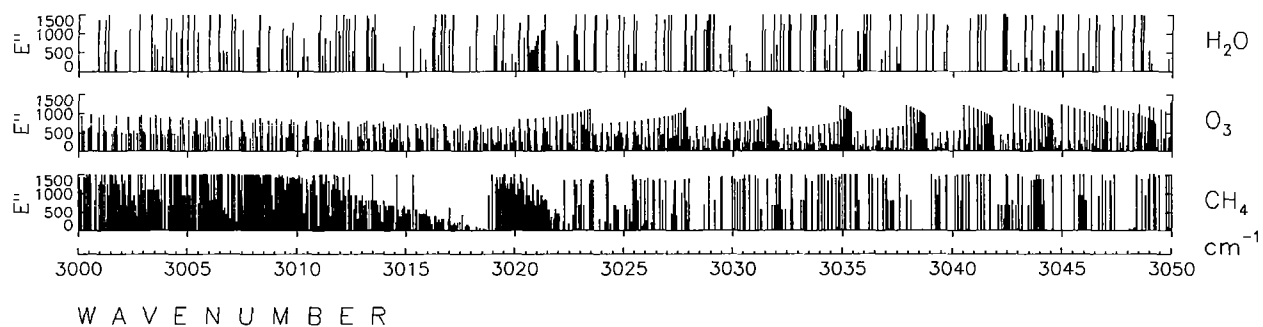
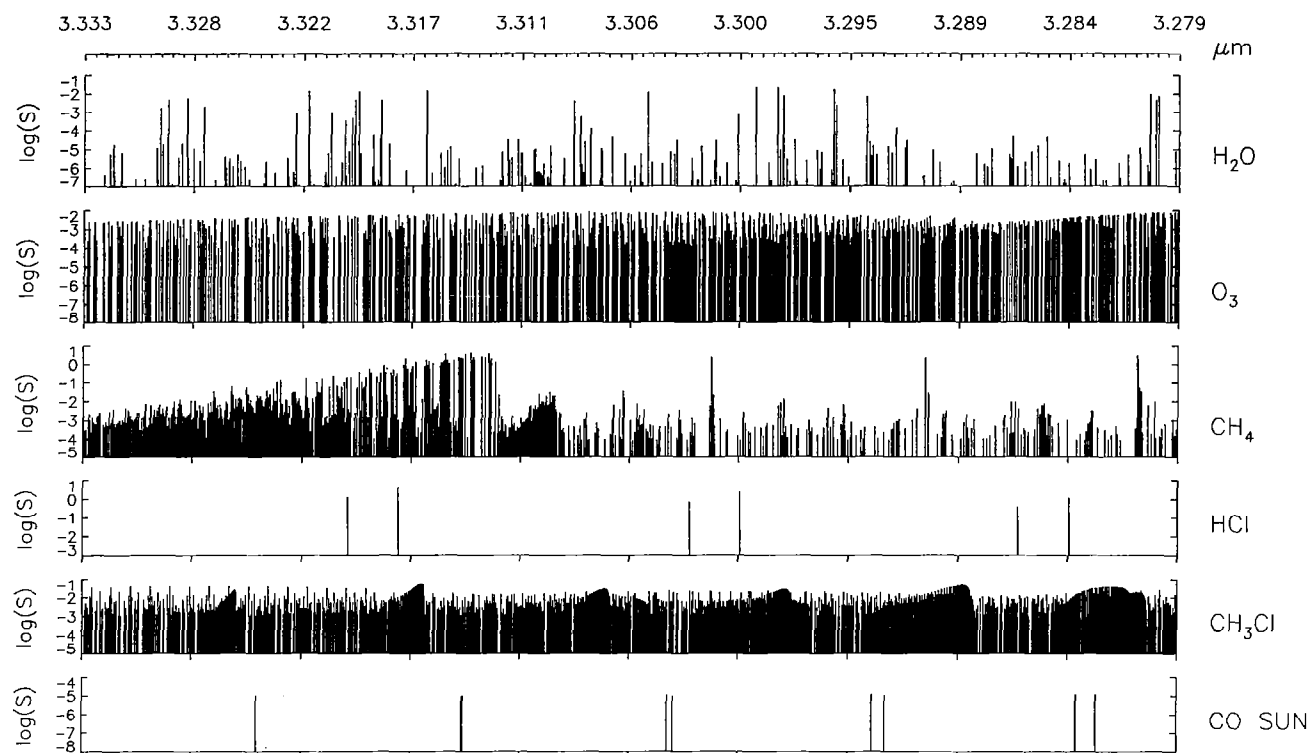
W A V E N U M B E R

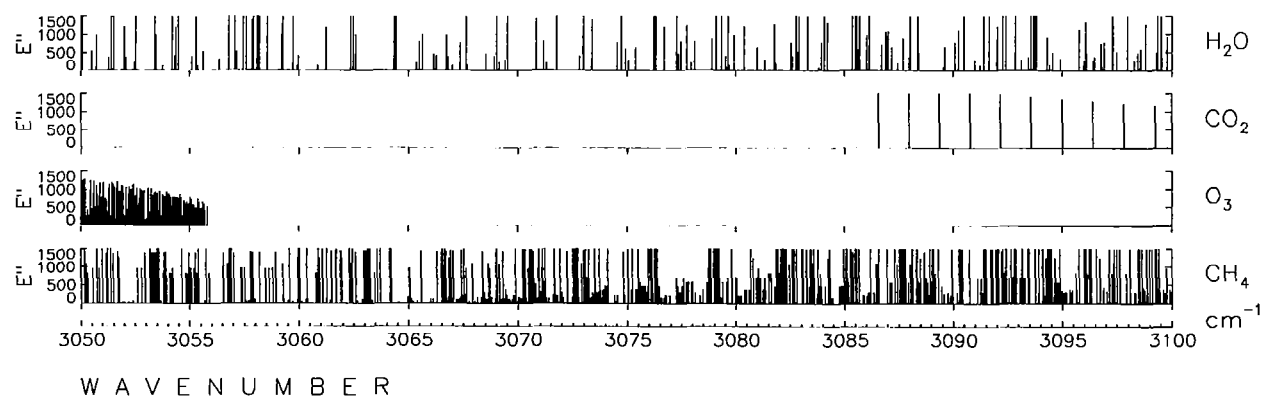
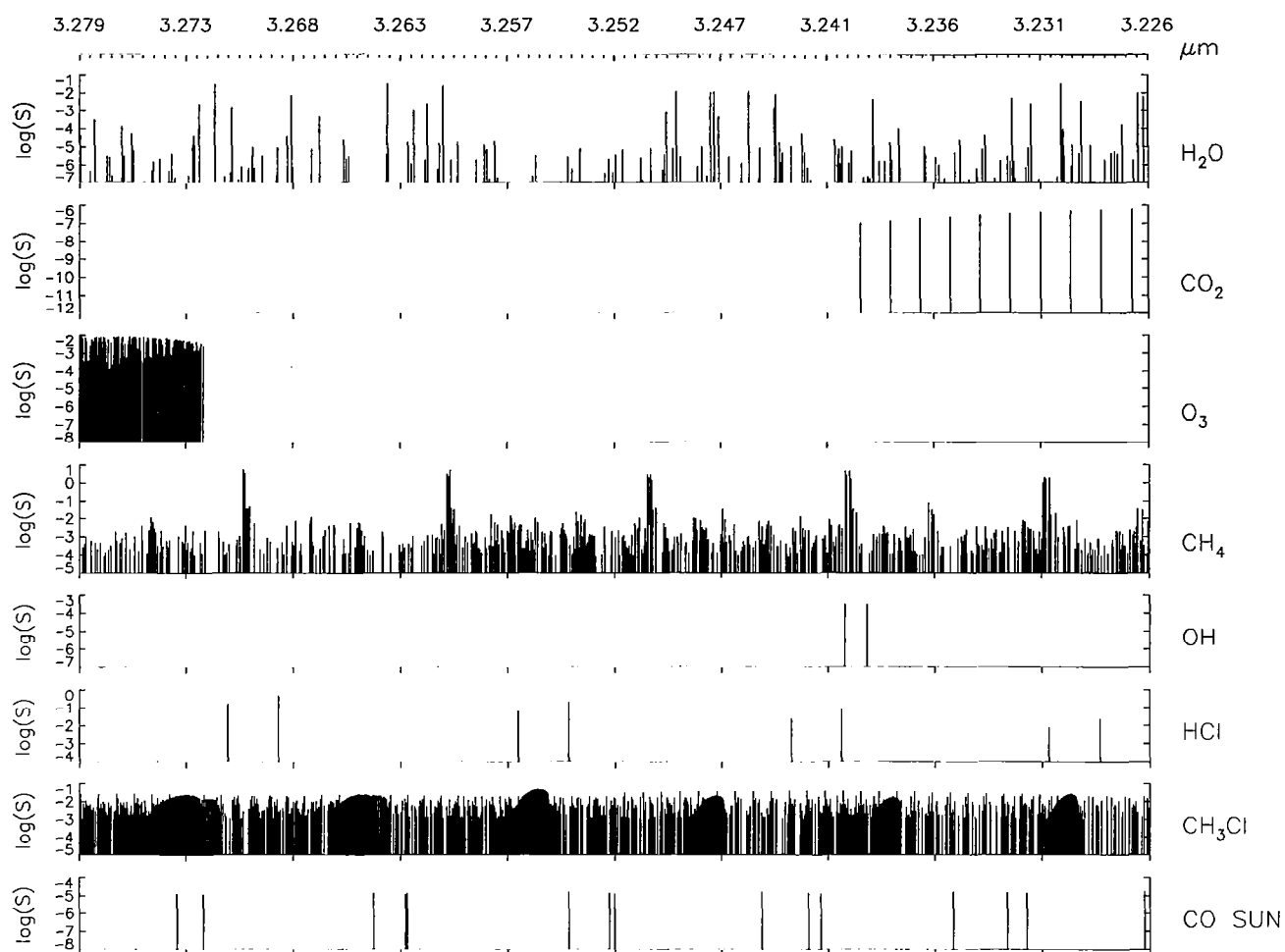




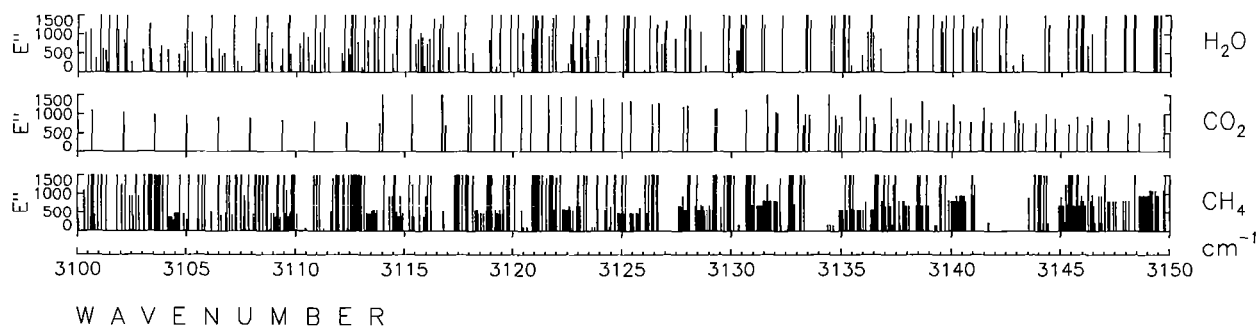
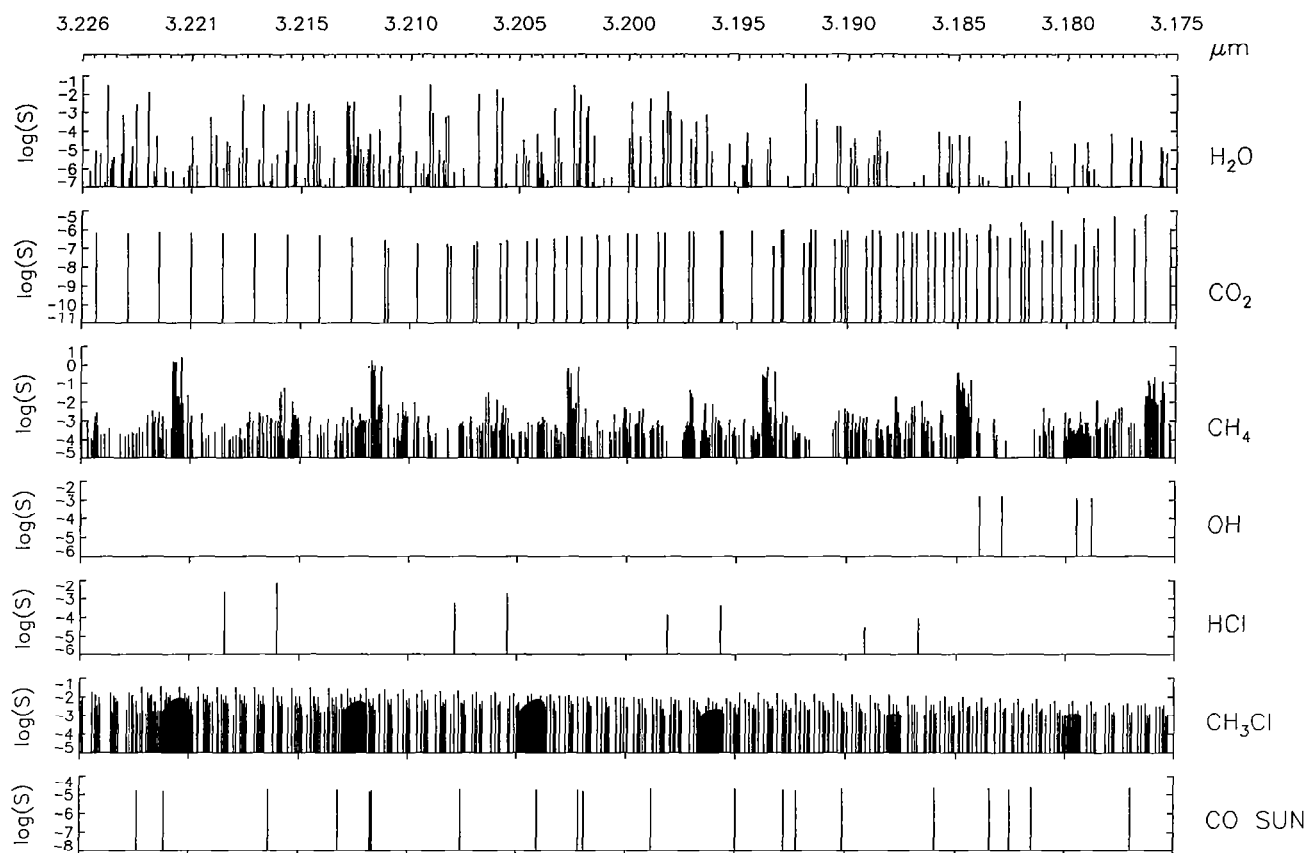


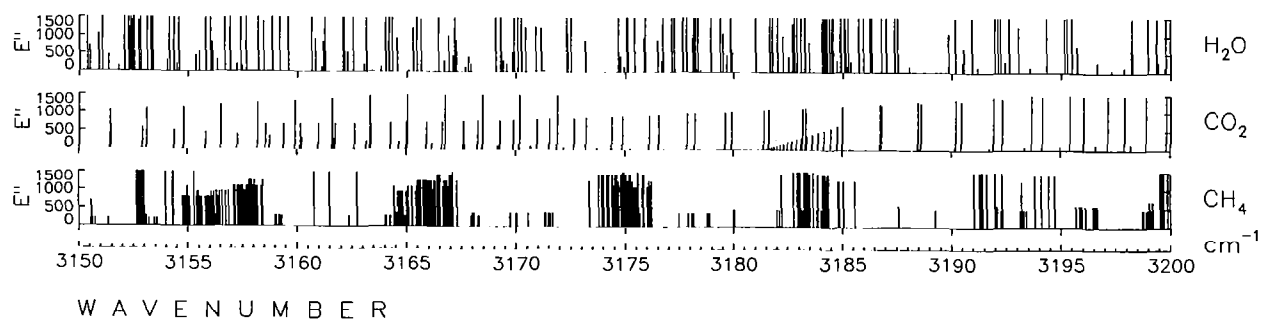
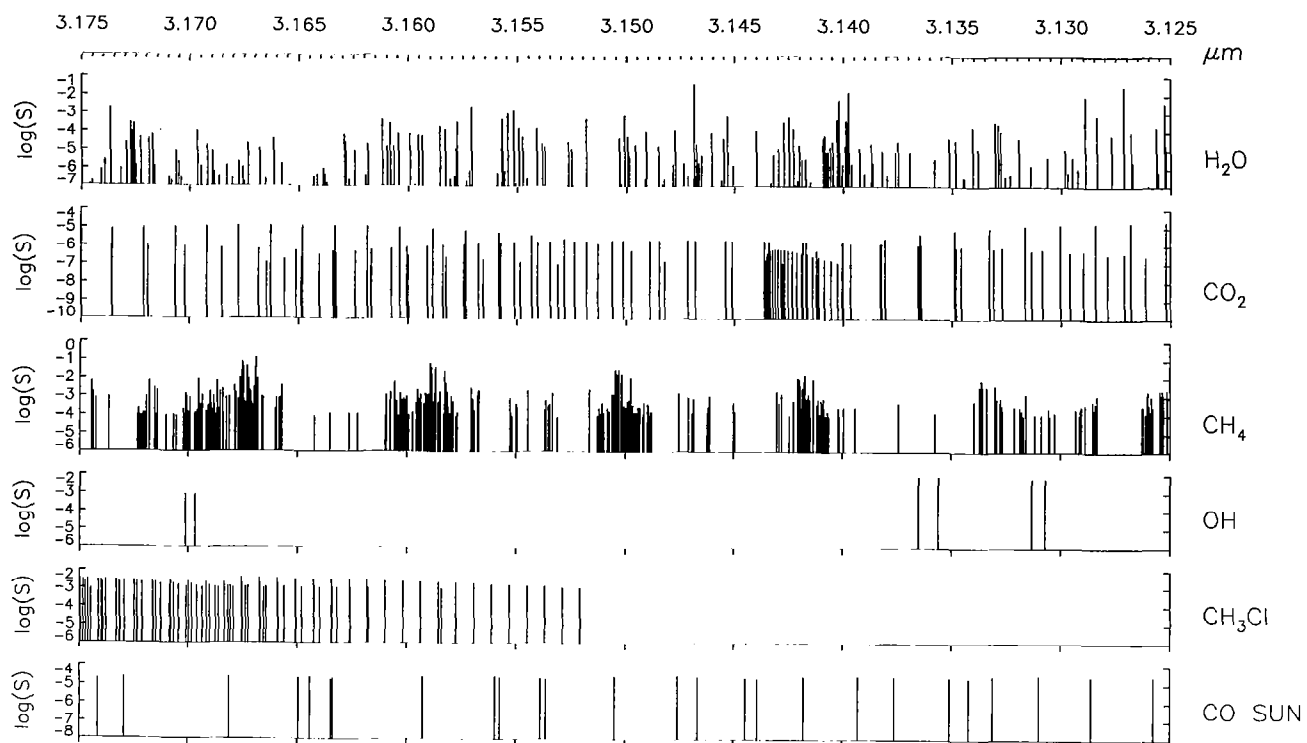


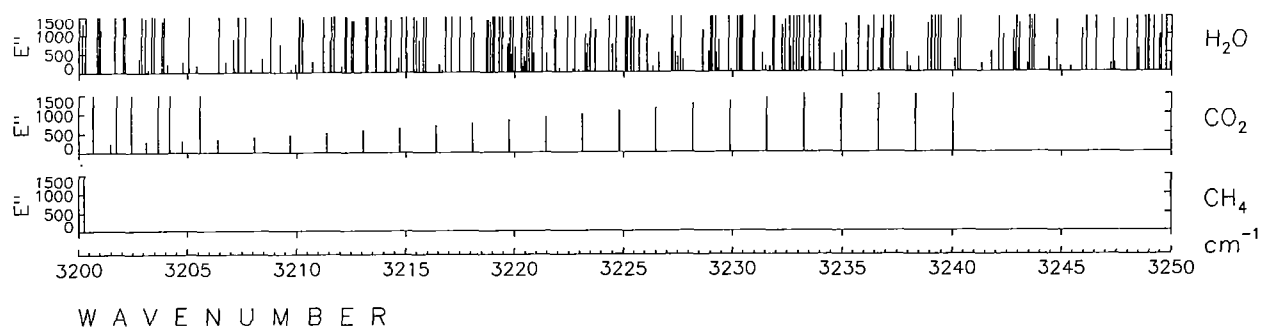
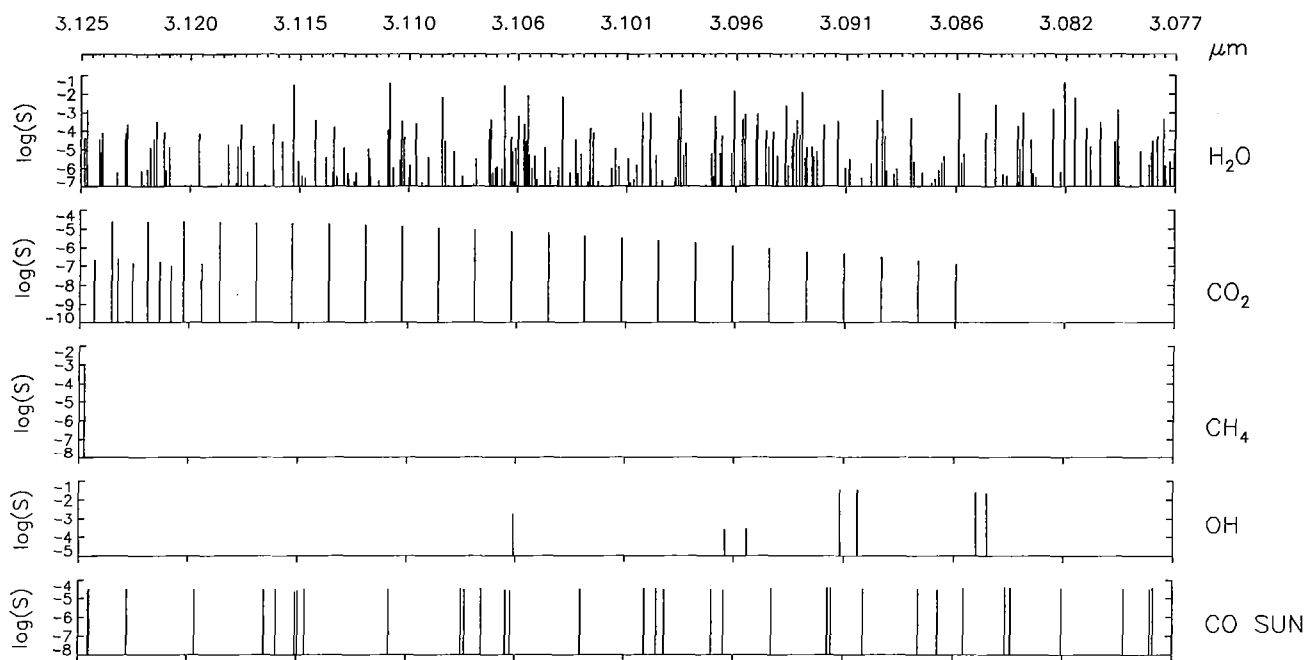


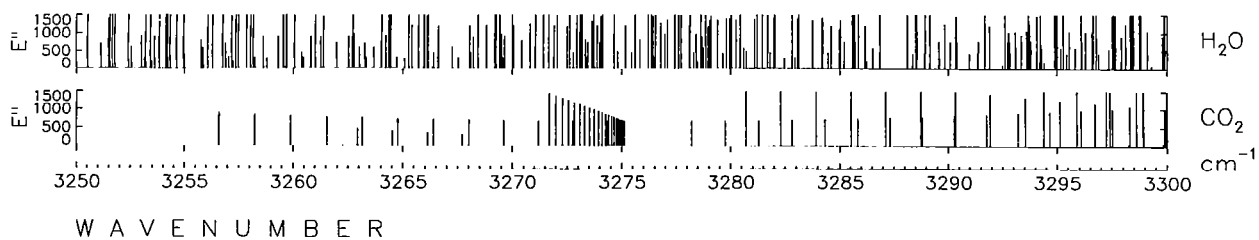
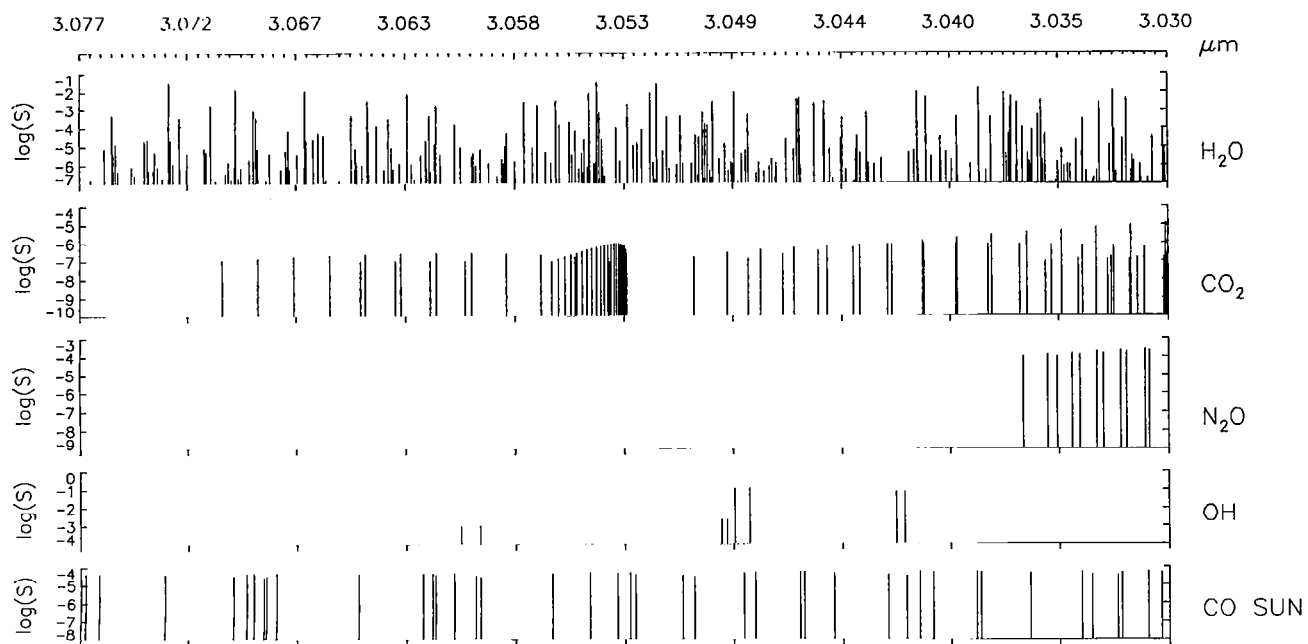


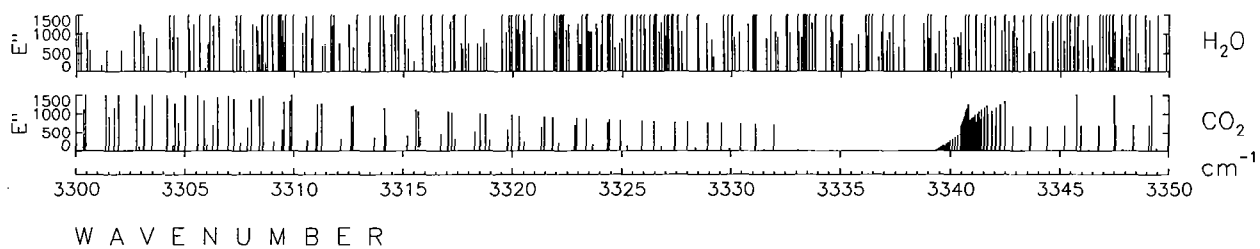
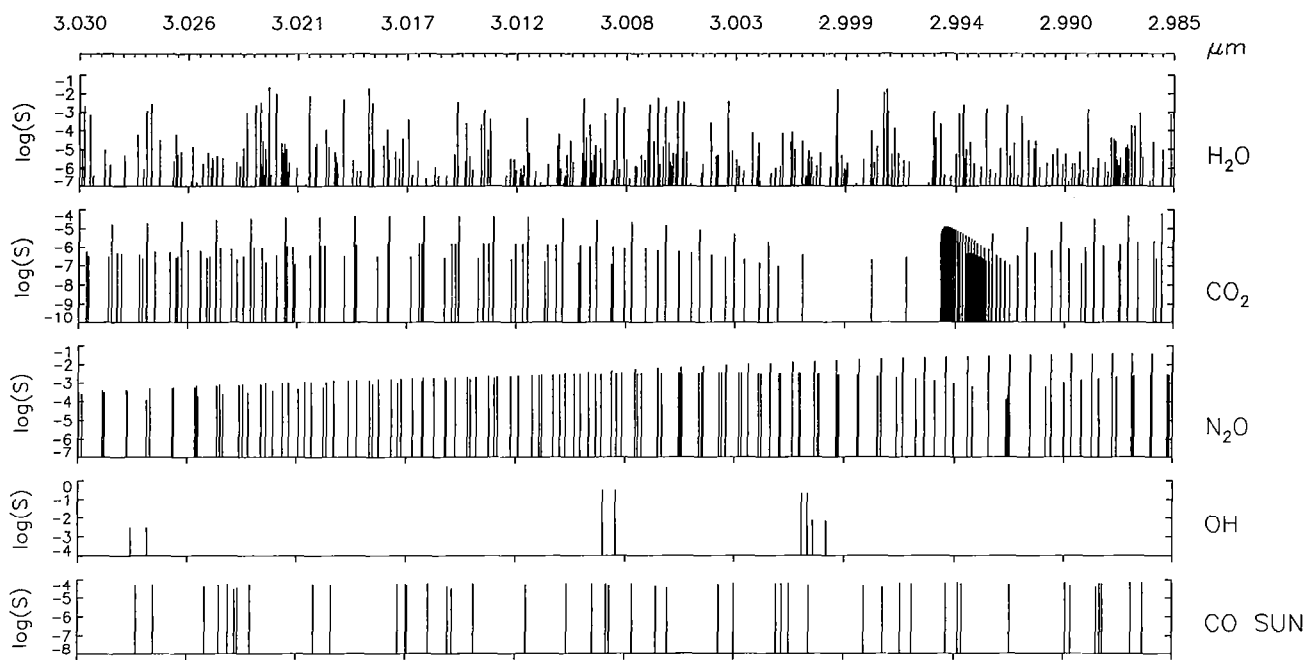


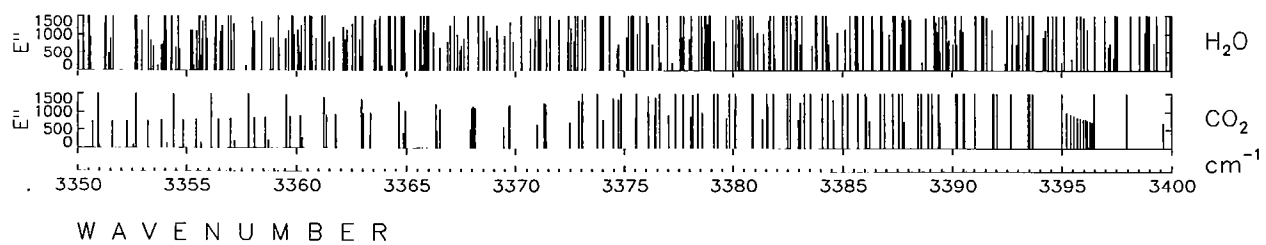
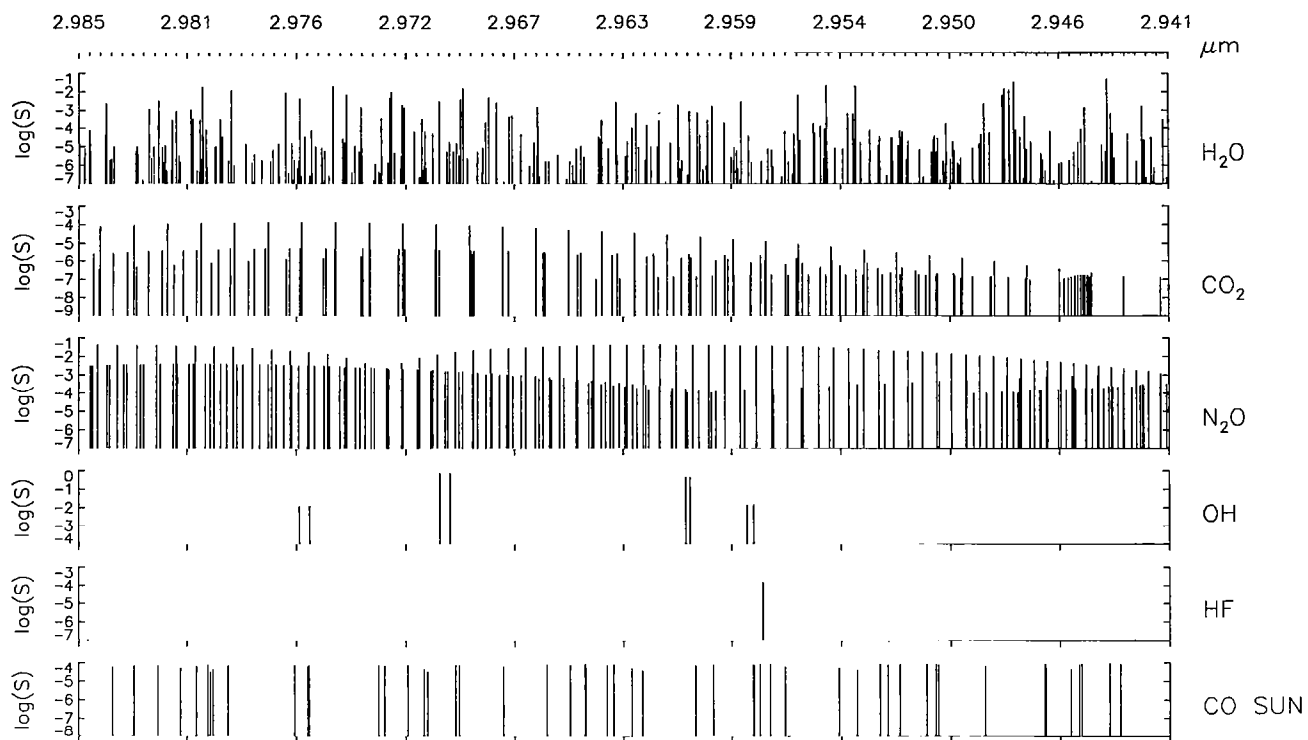


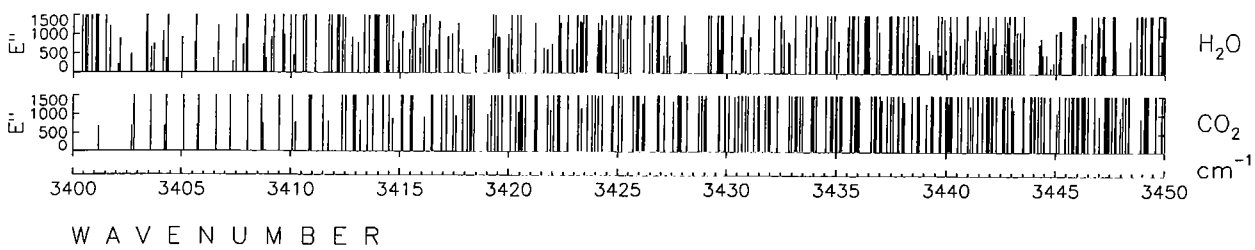
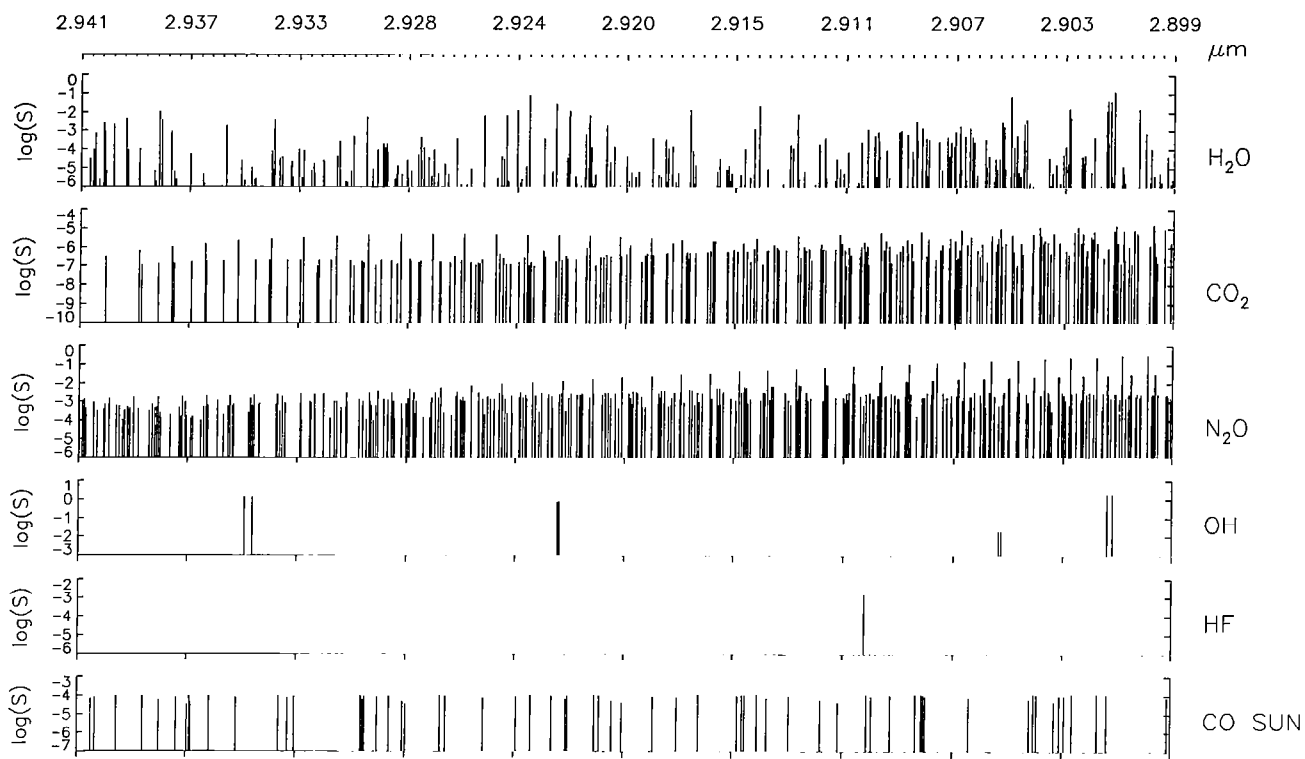


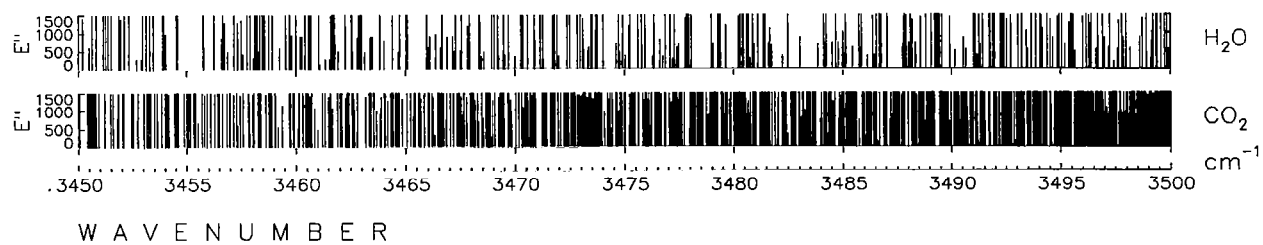
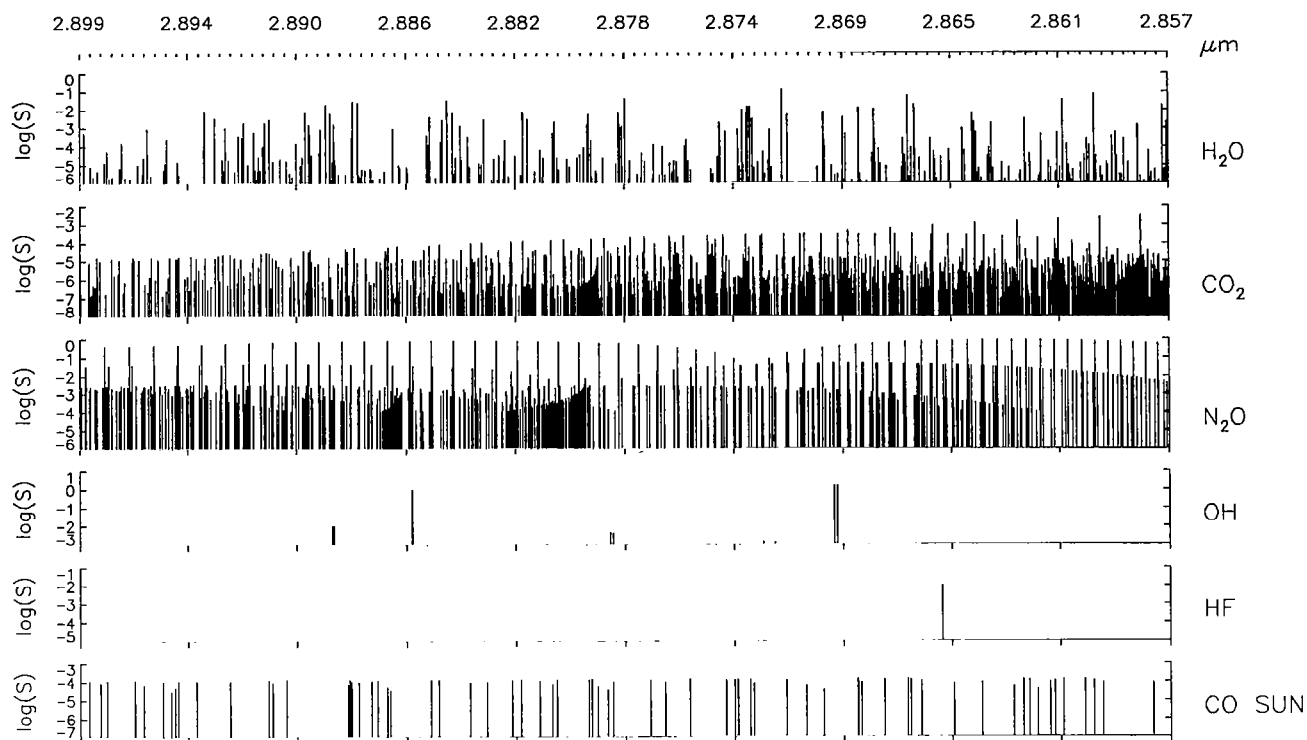




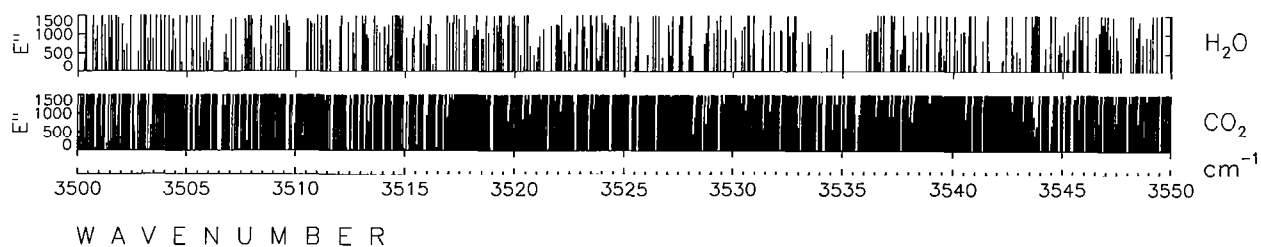
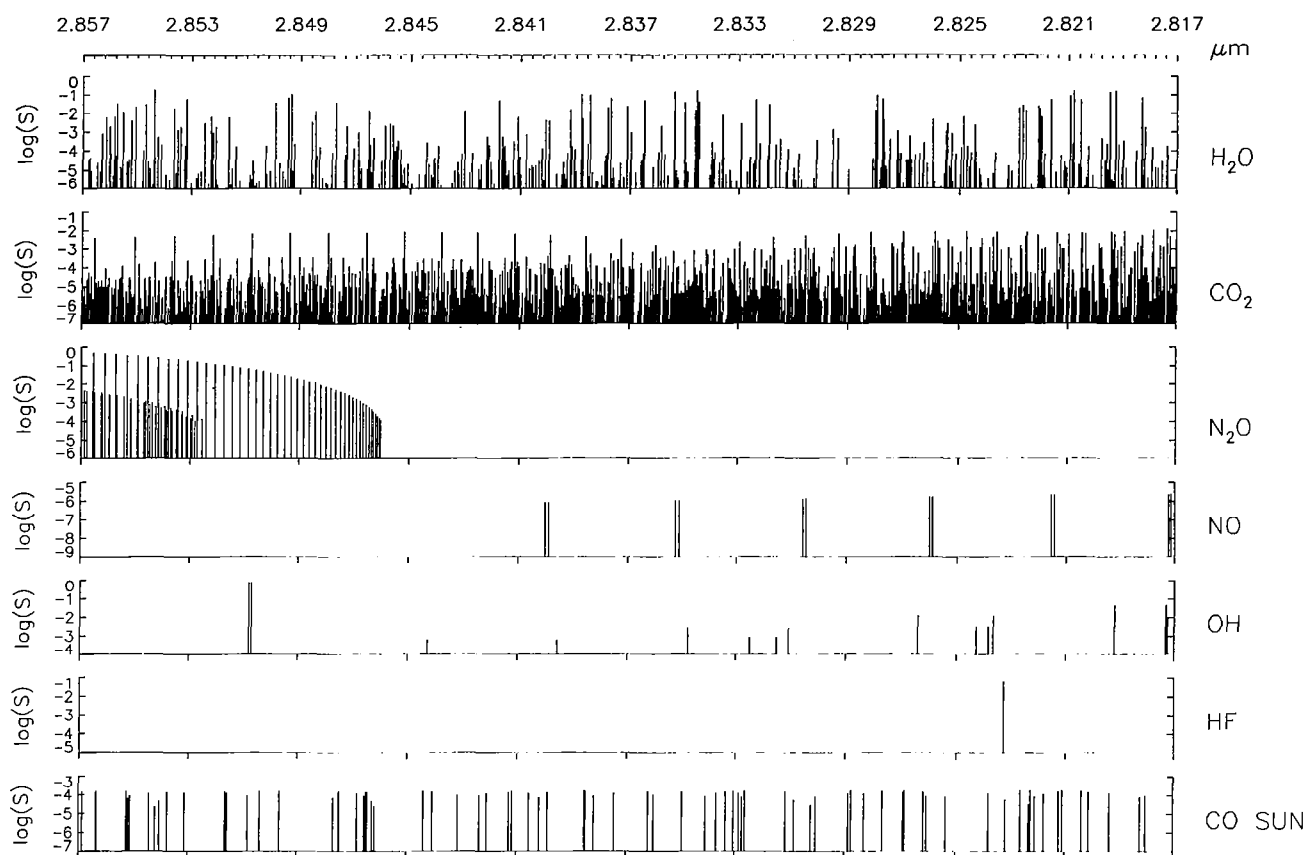


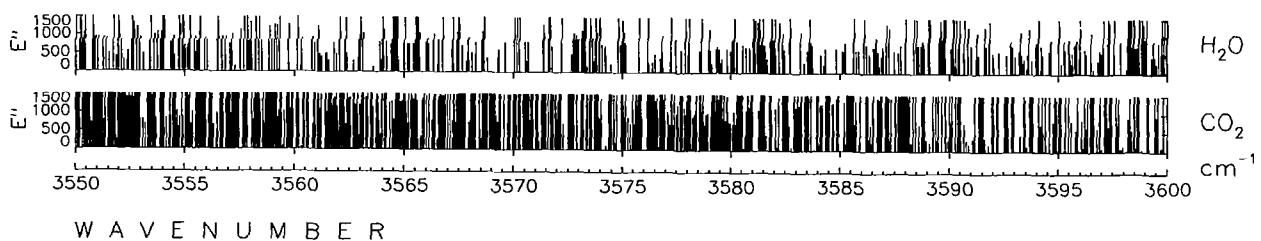
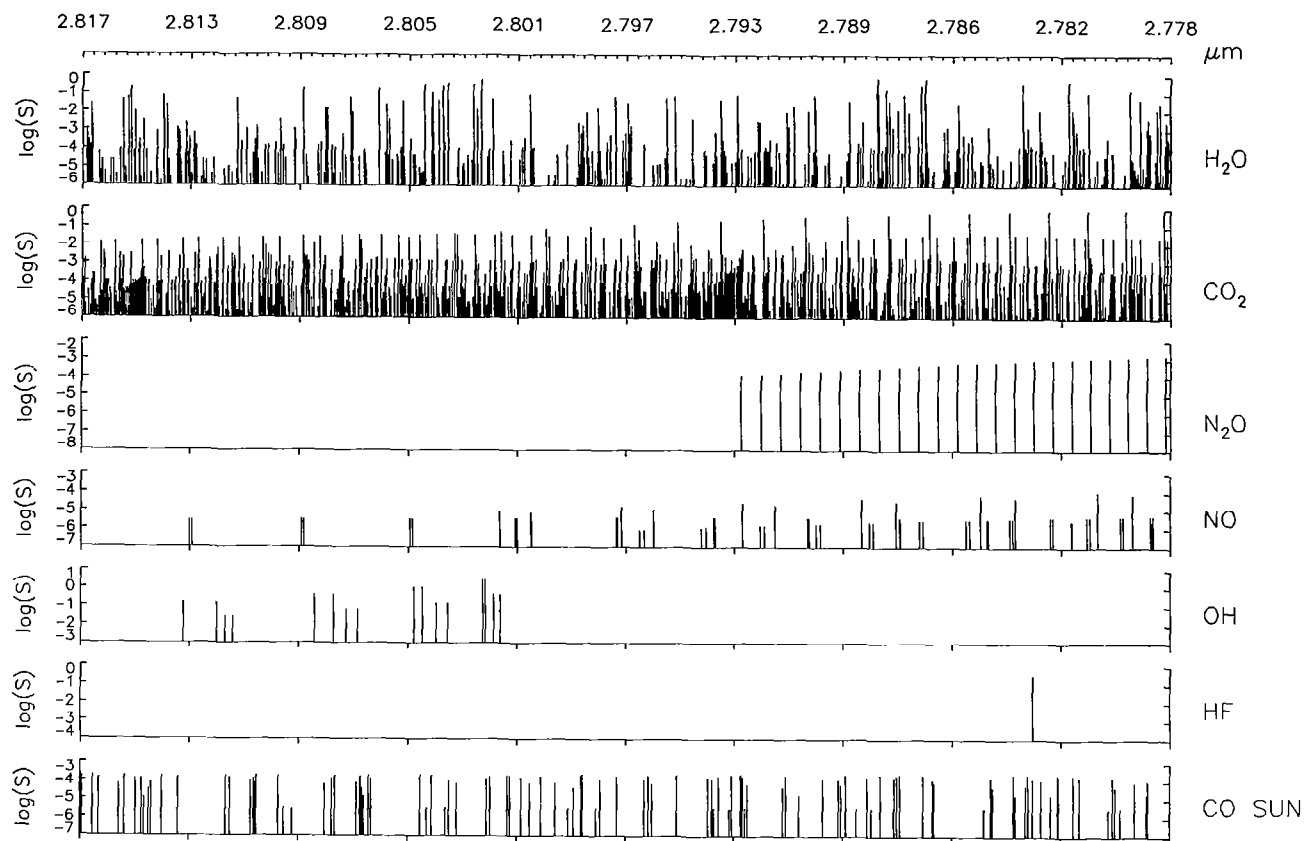


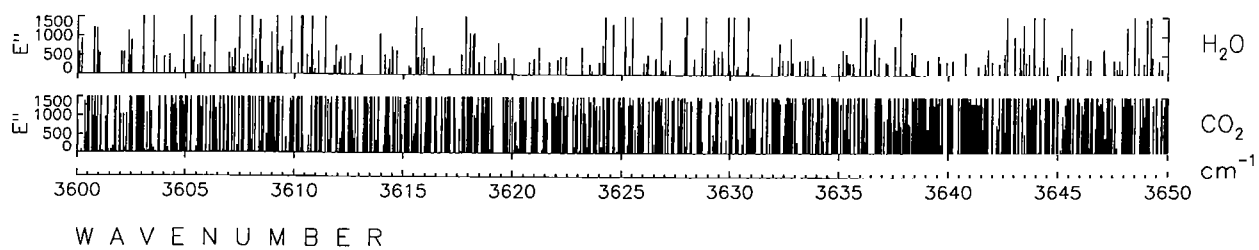
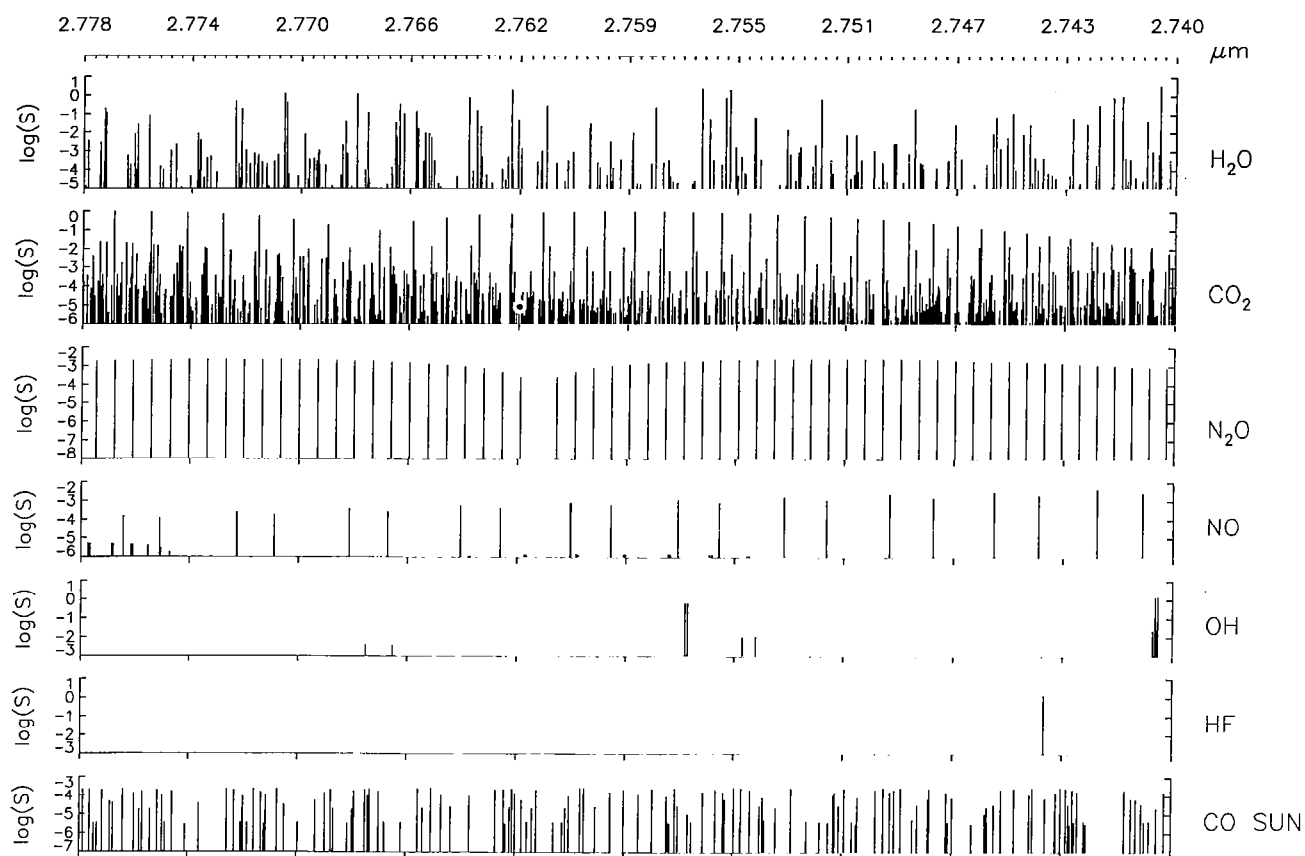


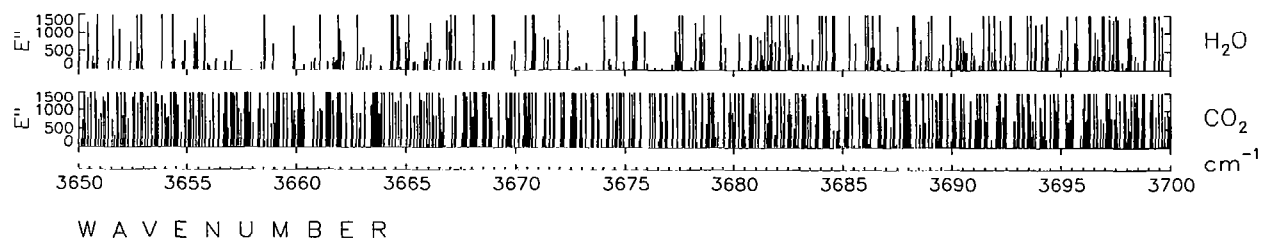
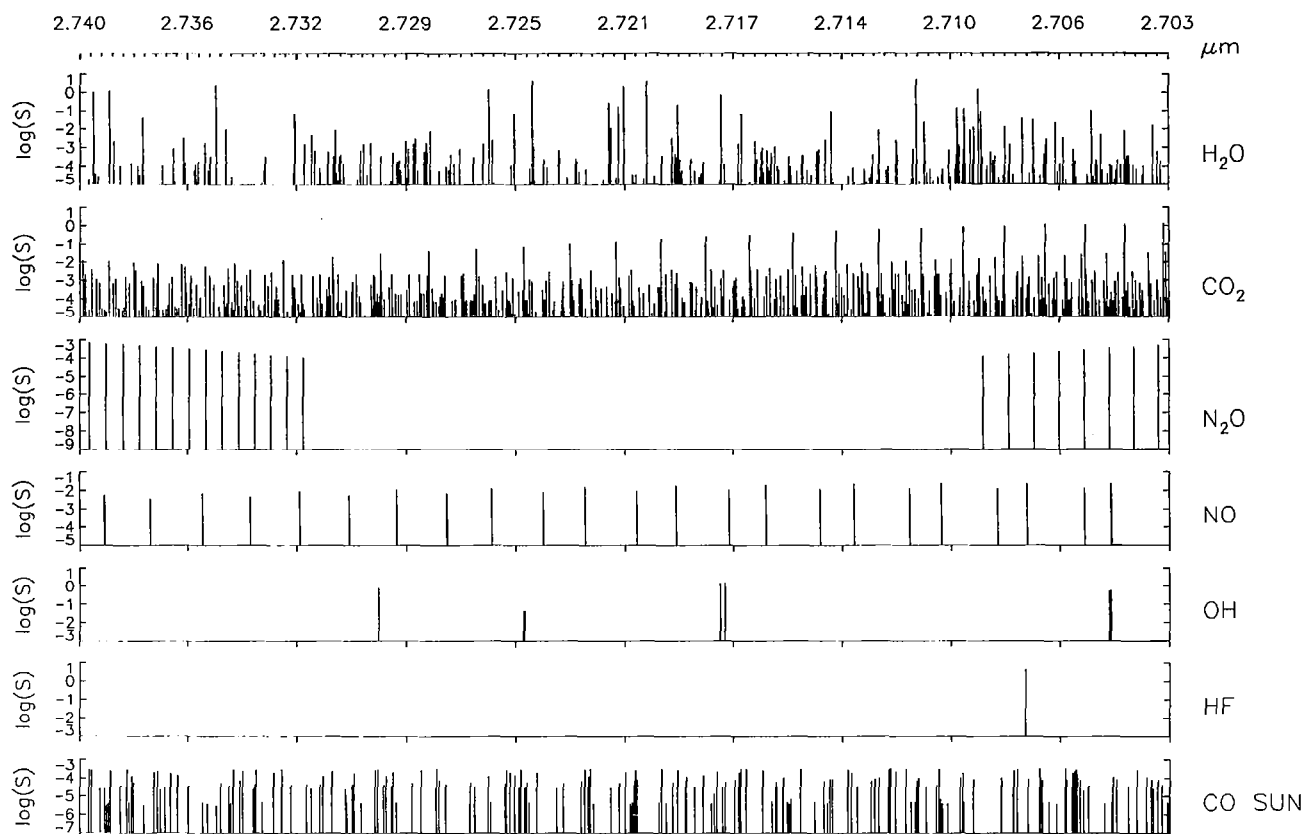


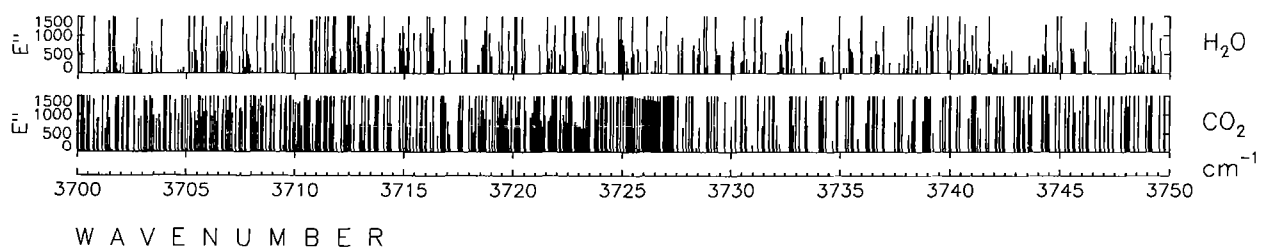
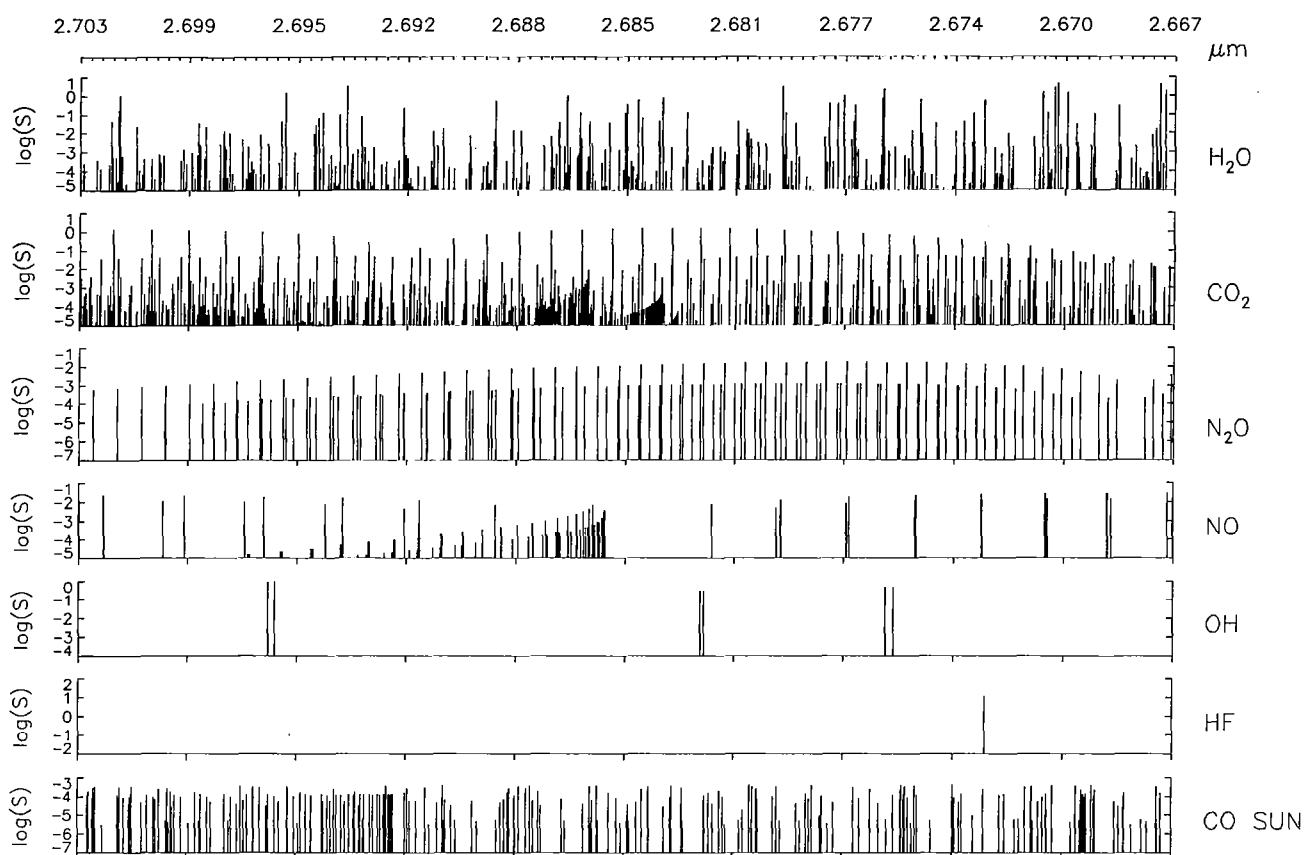


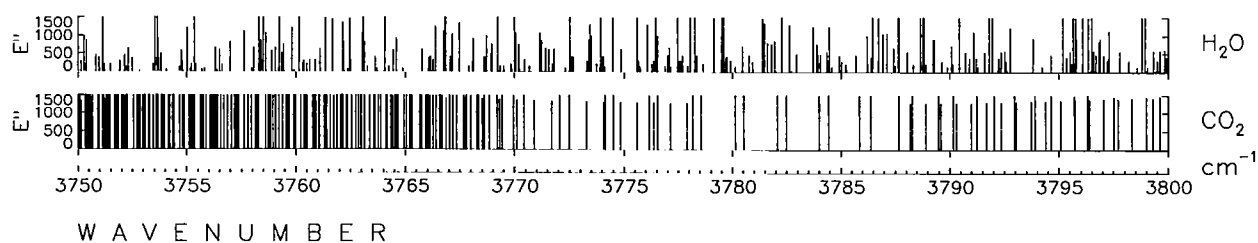
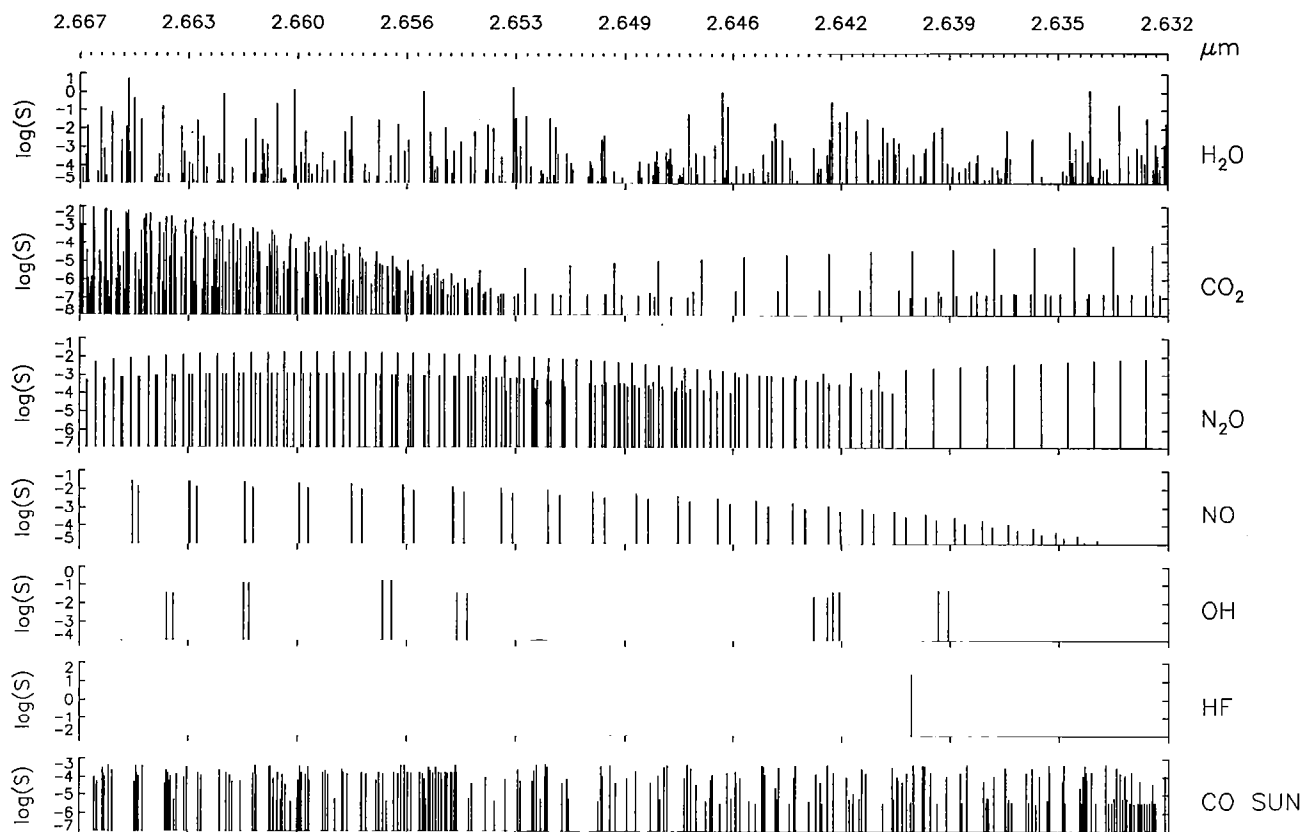


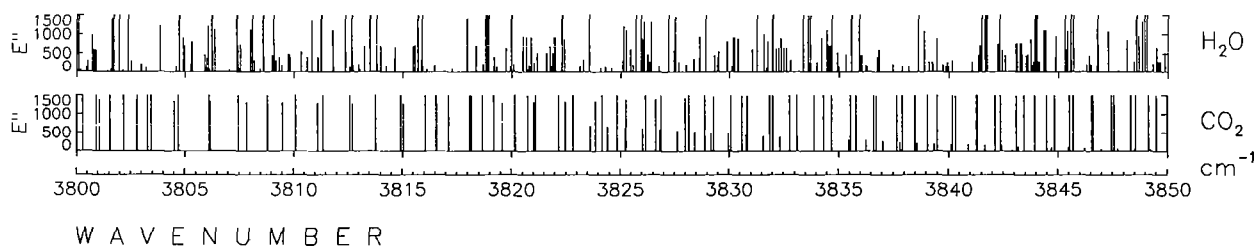
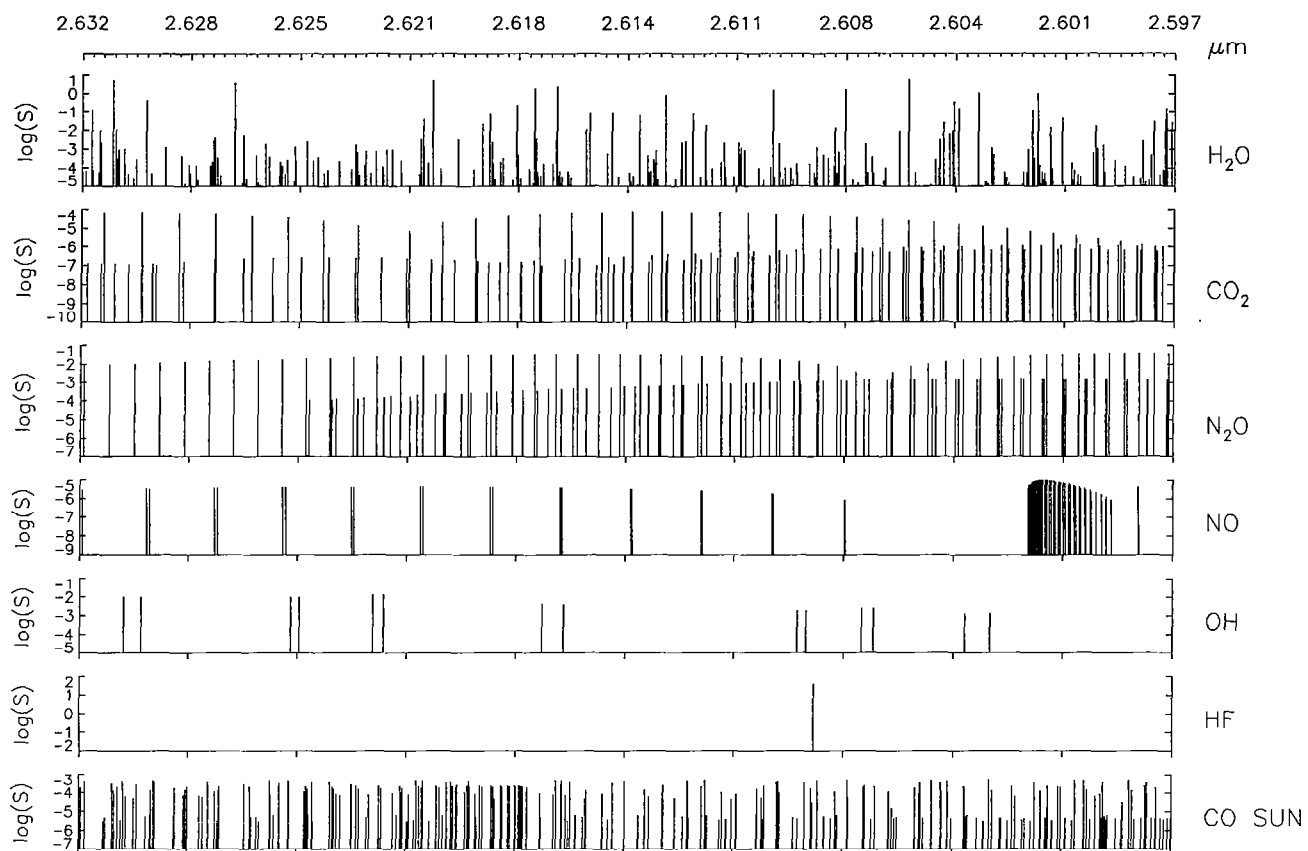


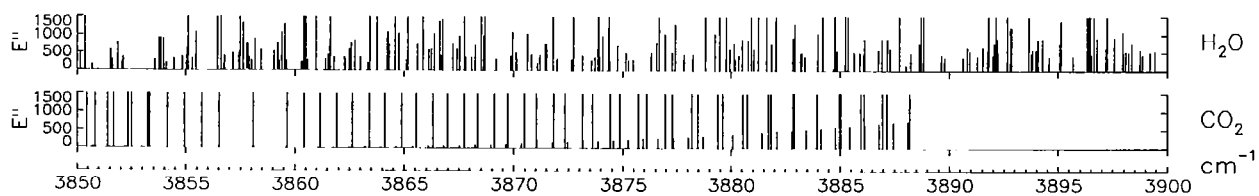
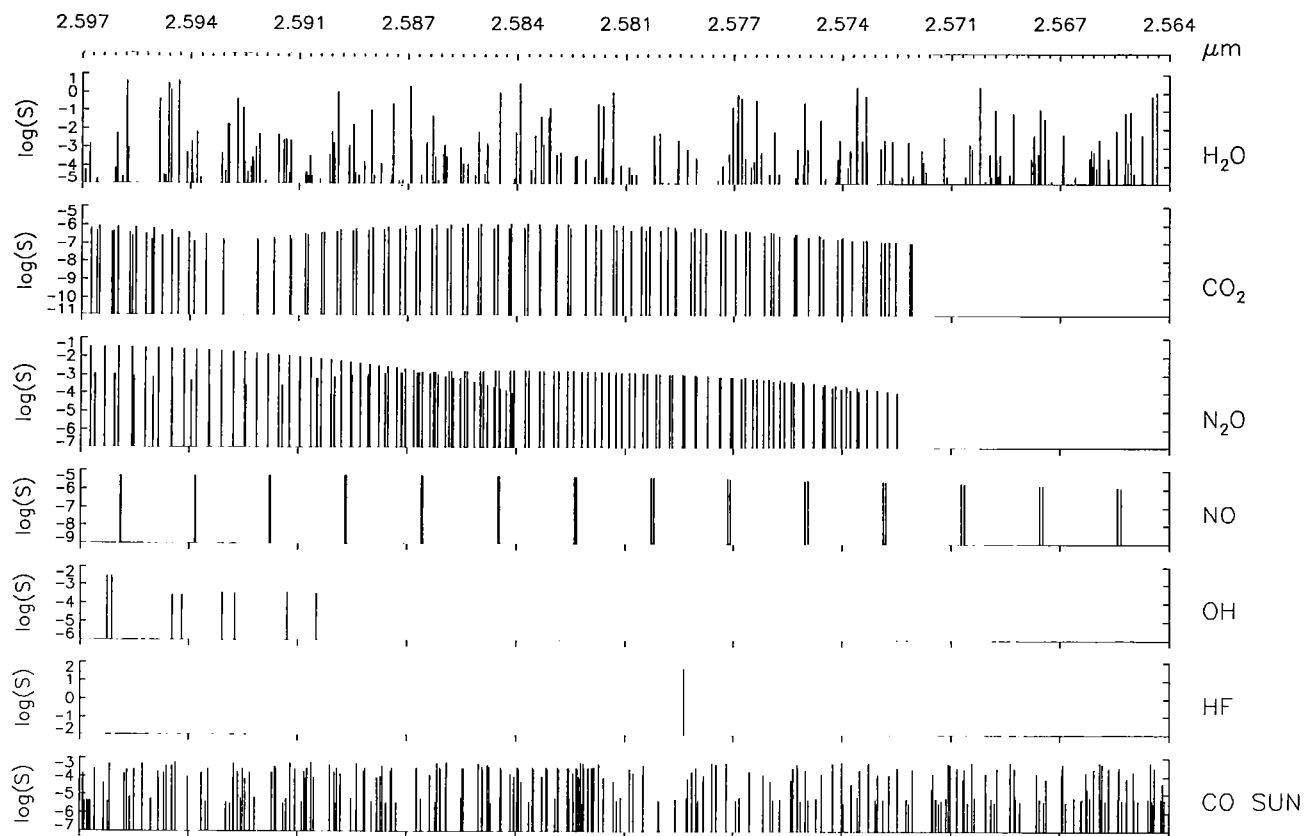






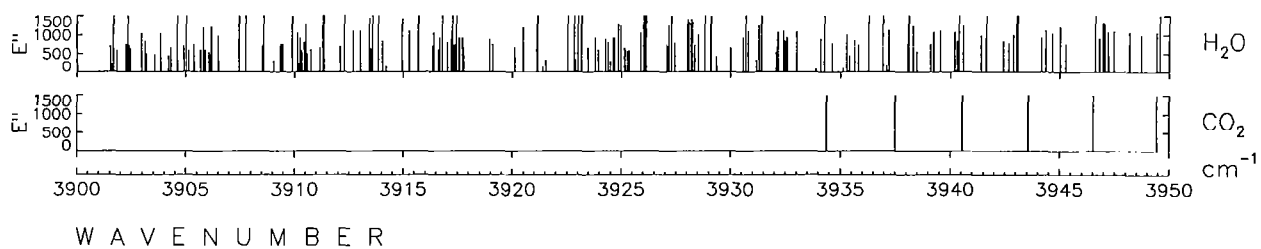
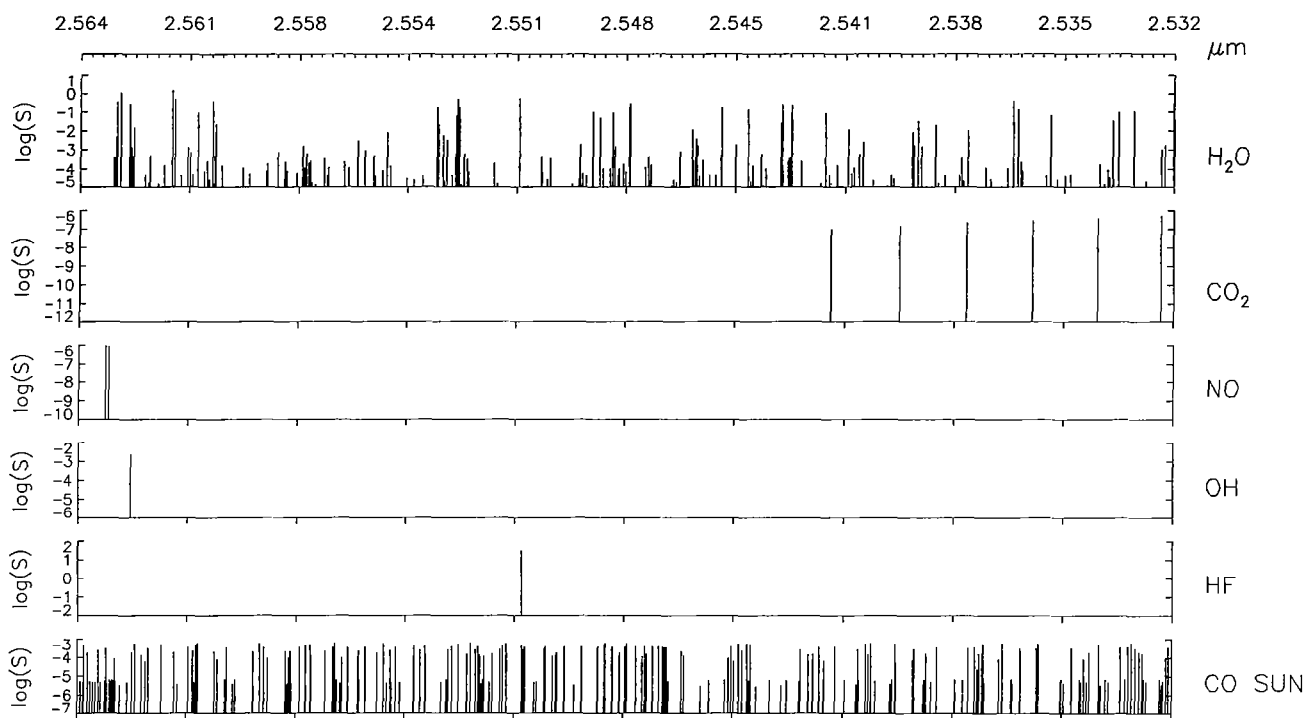


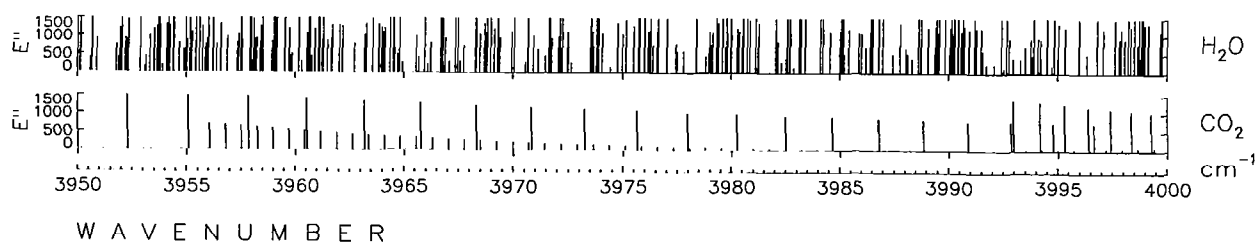
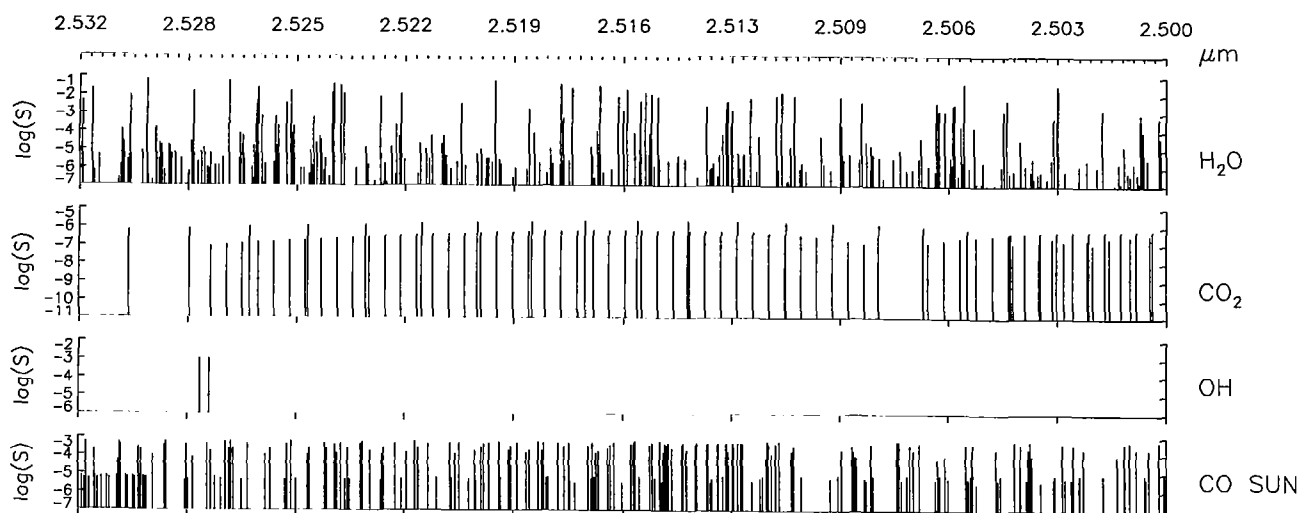


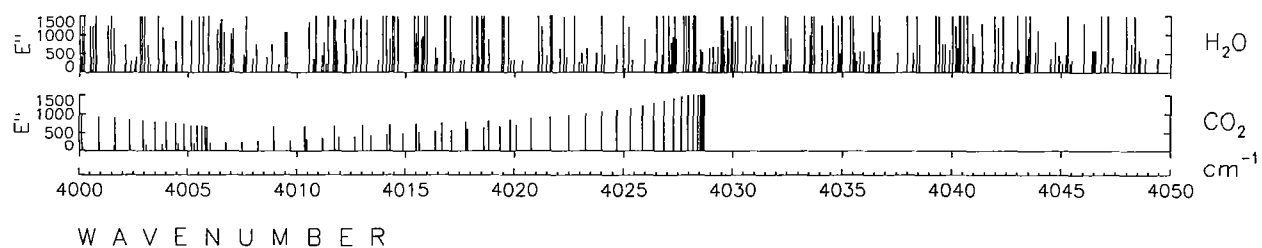
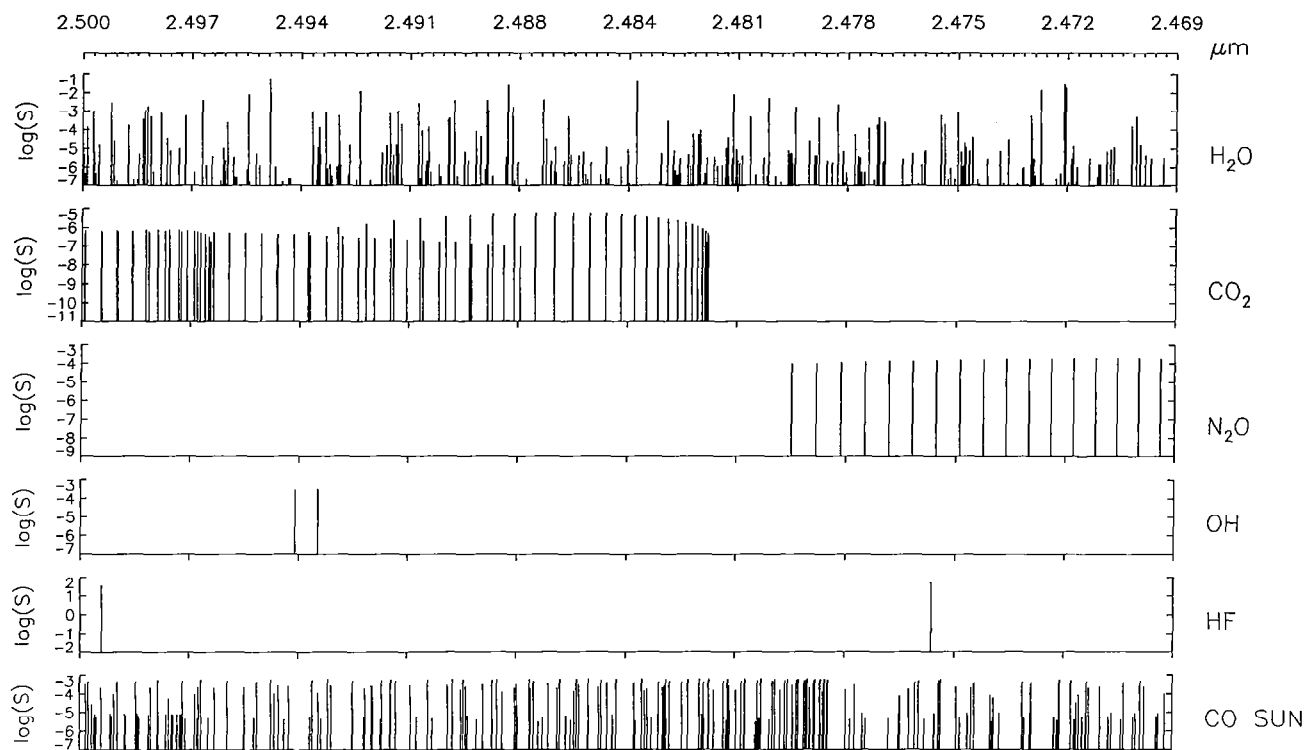


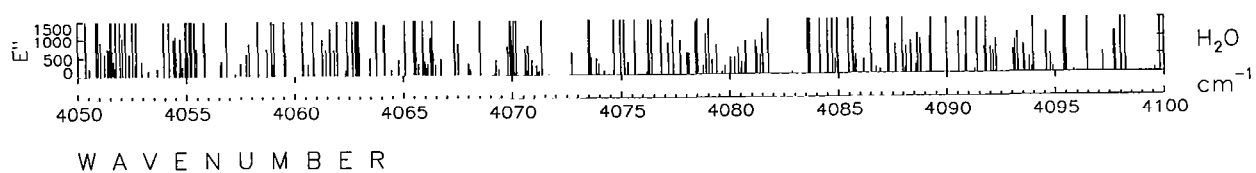
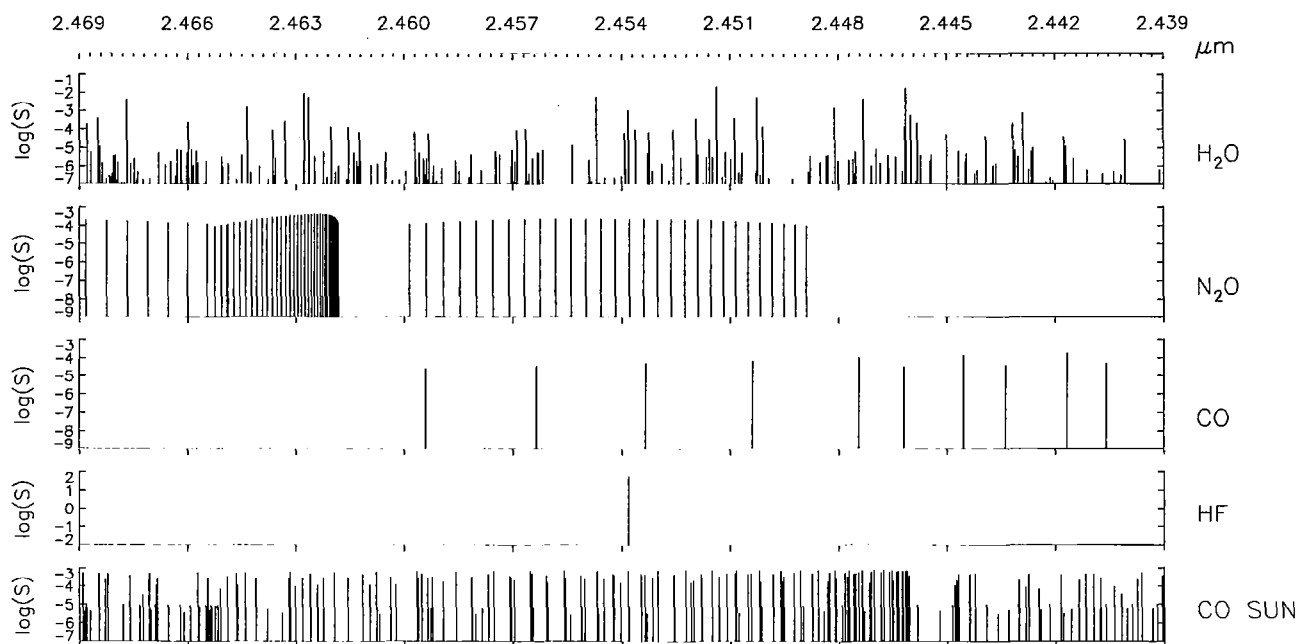
W A V E N U M B E R

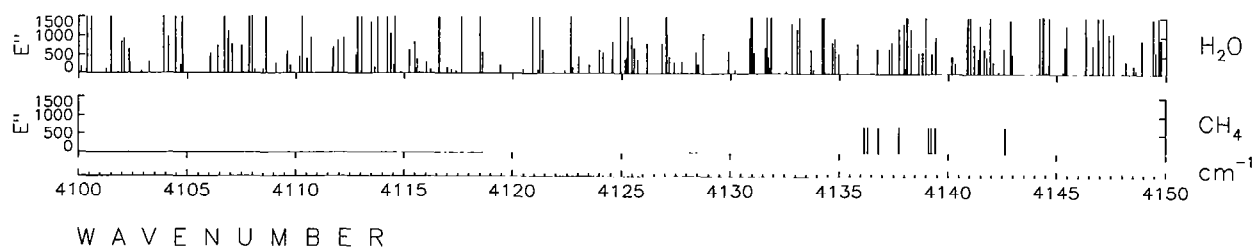
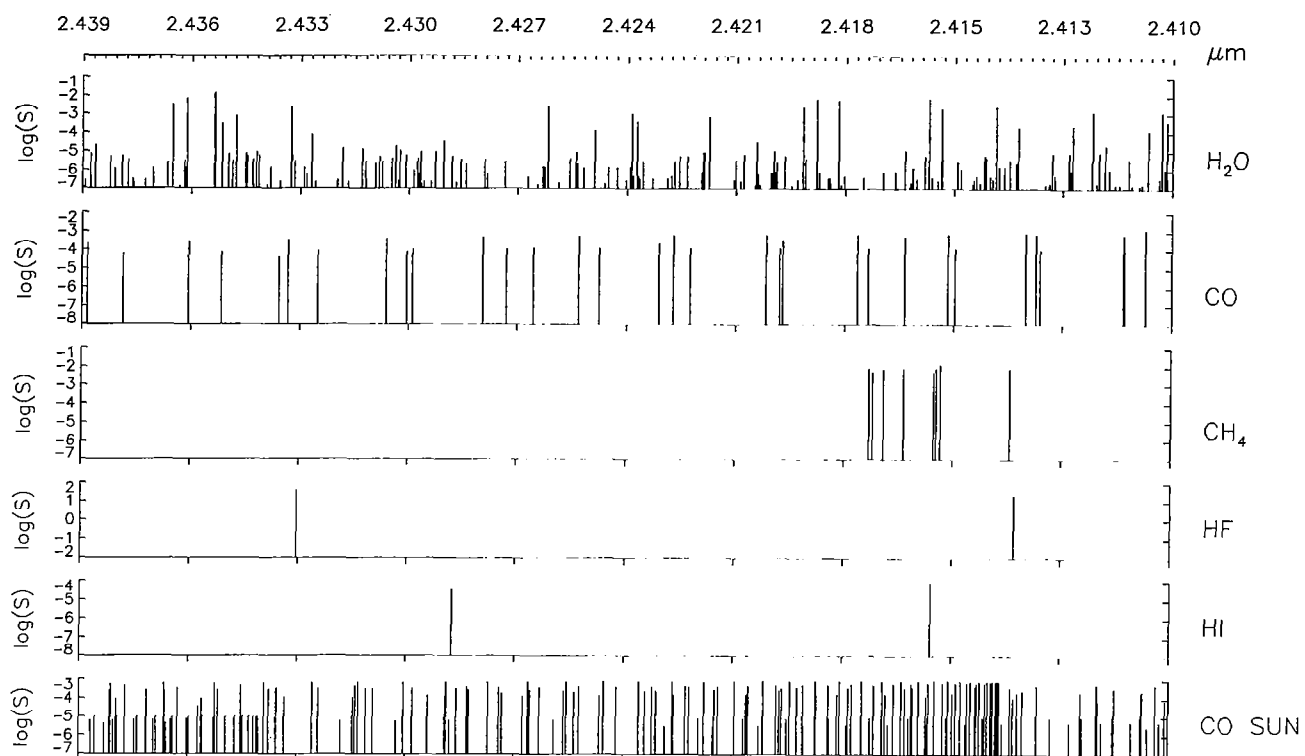


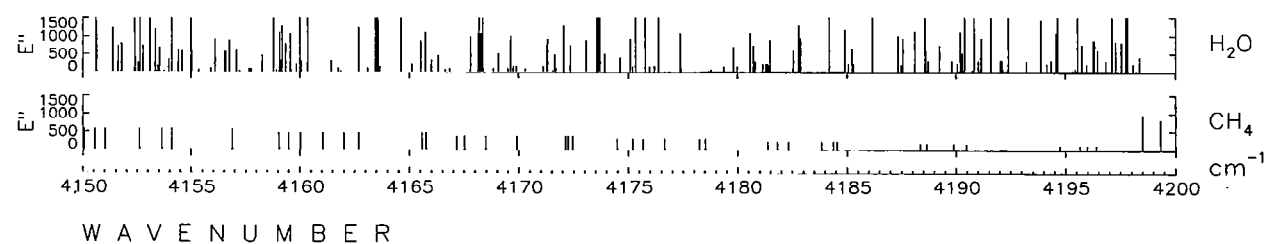
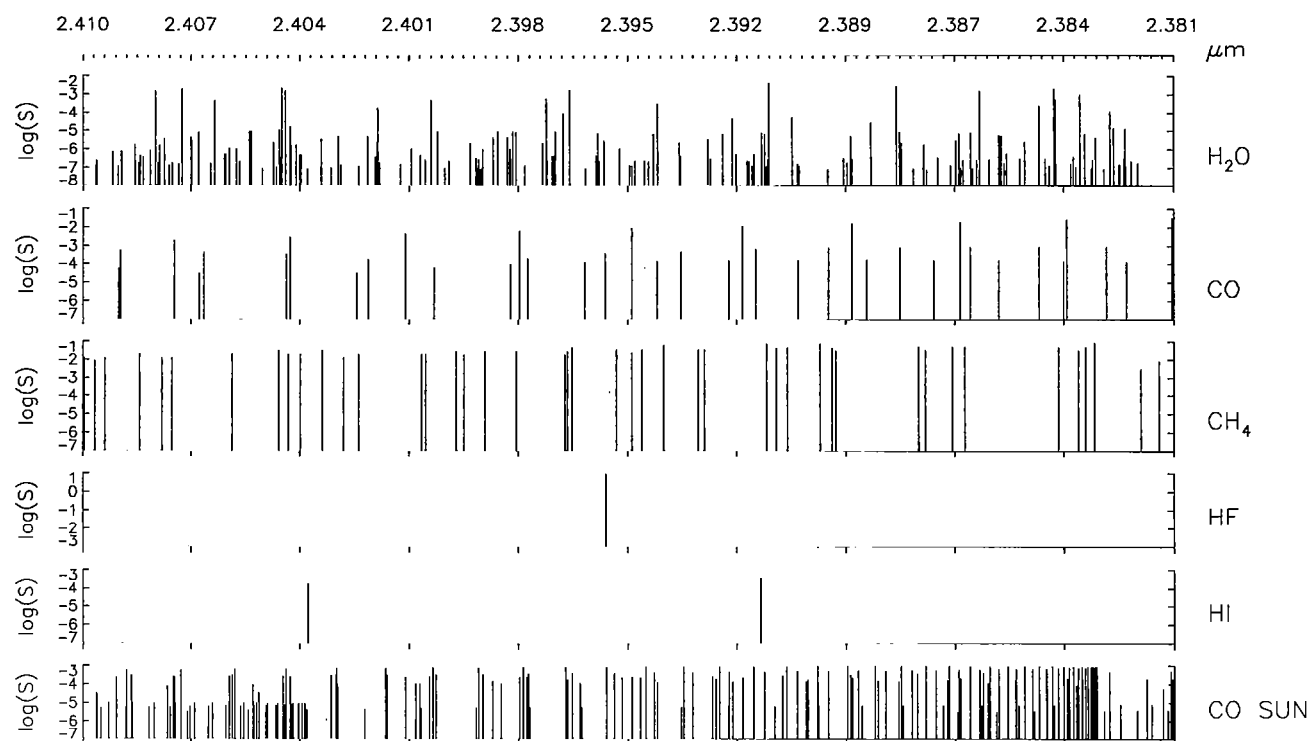


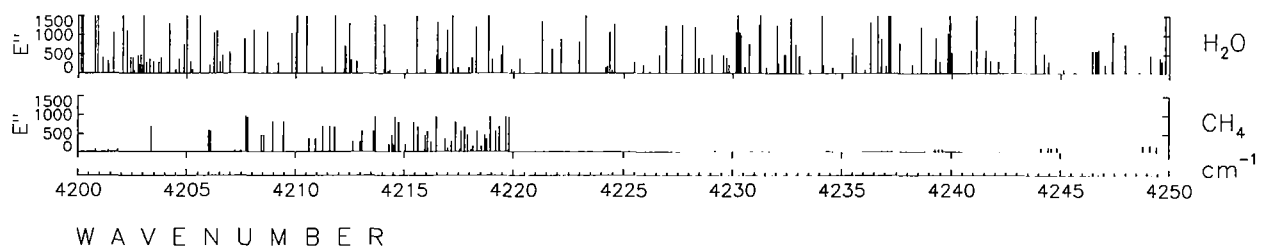
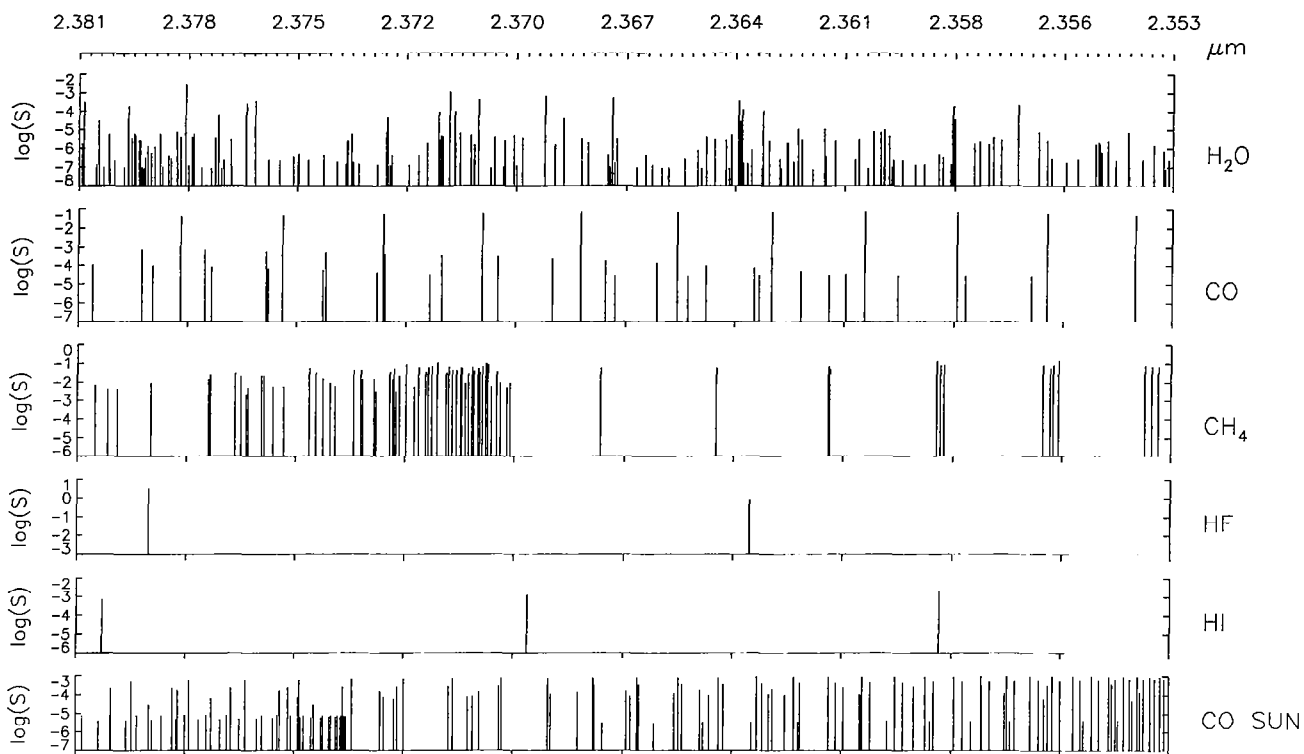


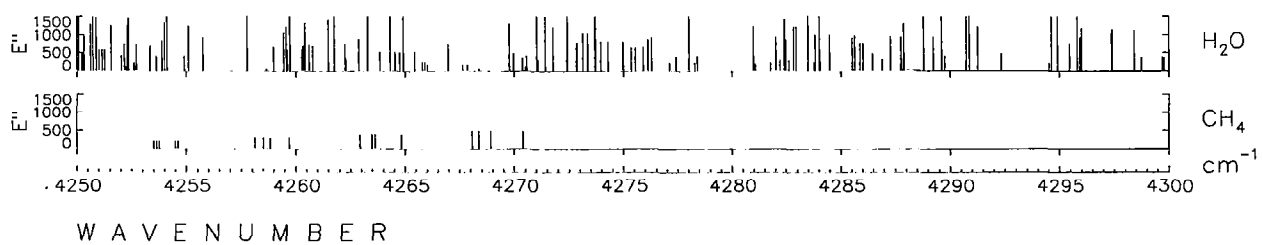
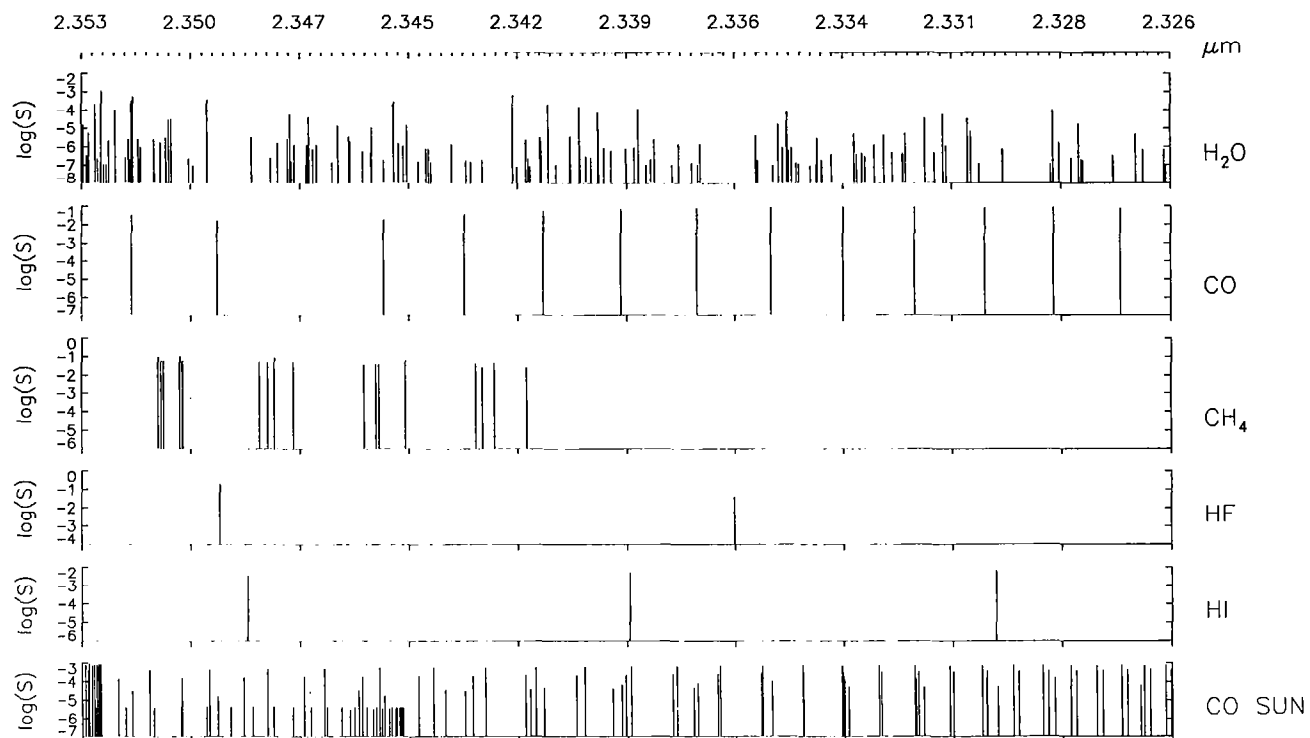




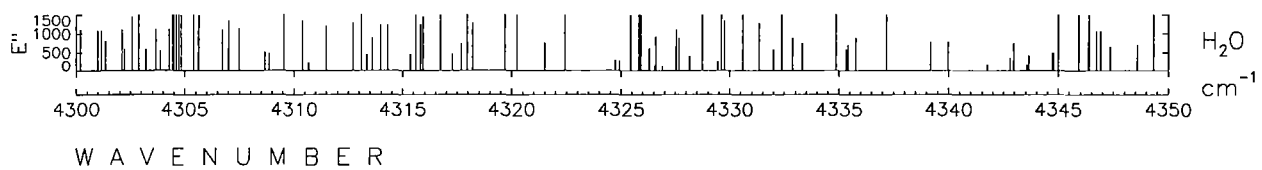
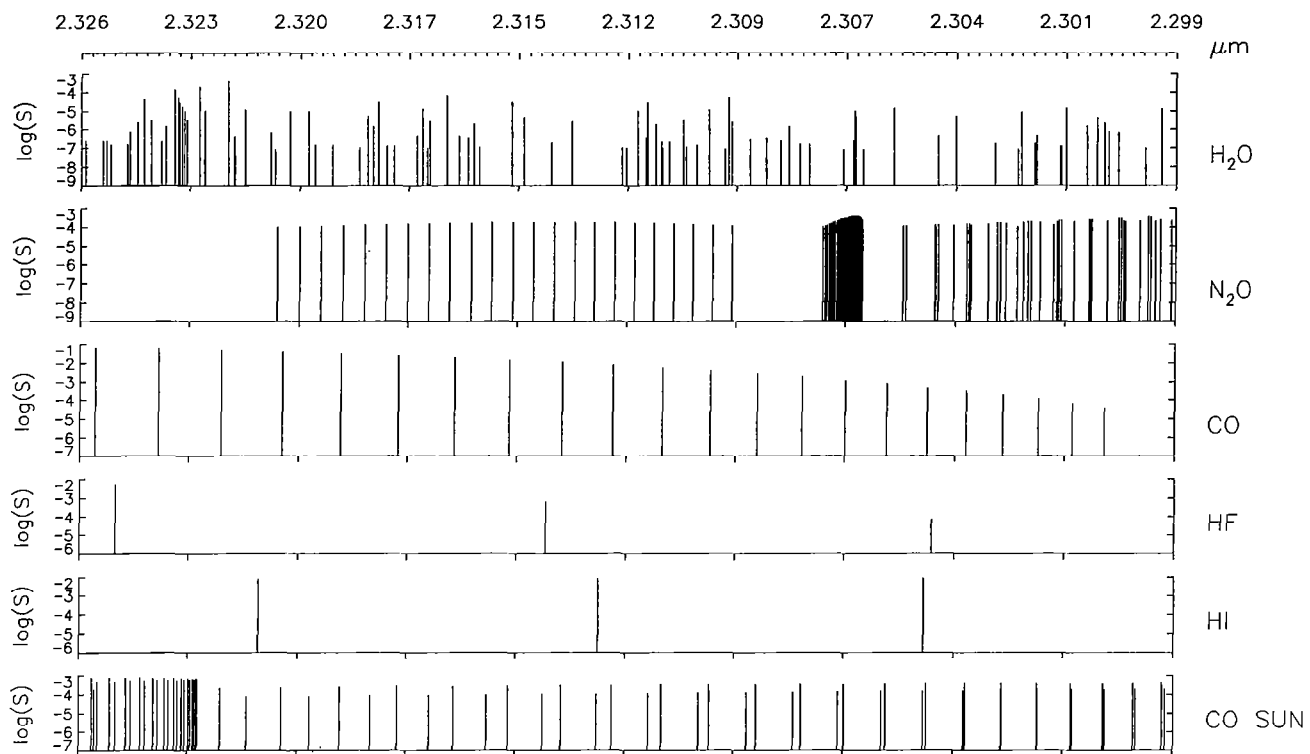


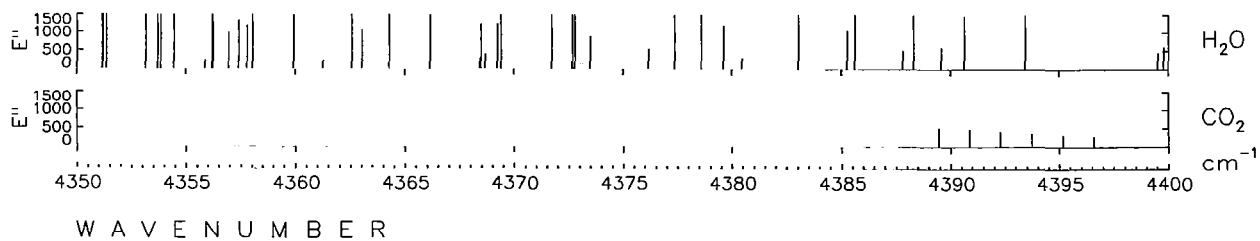
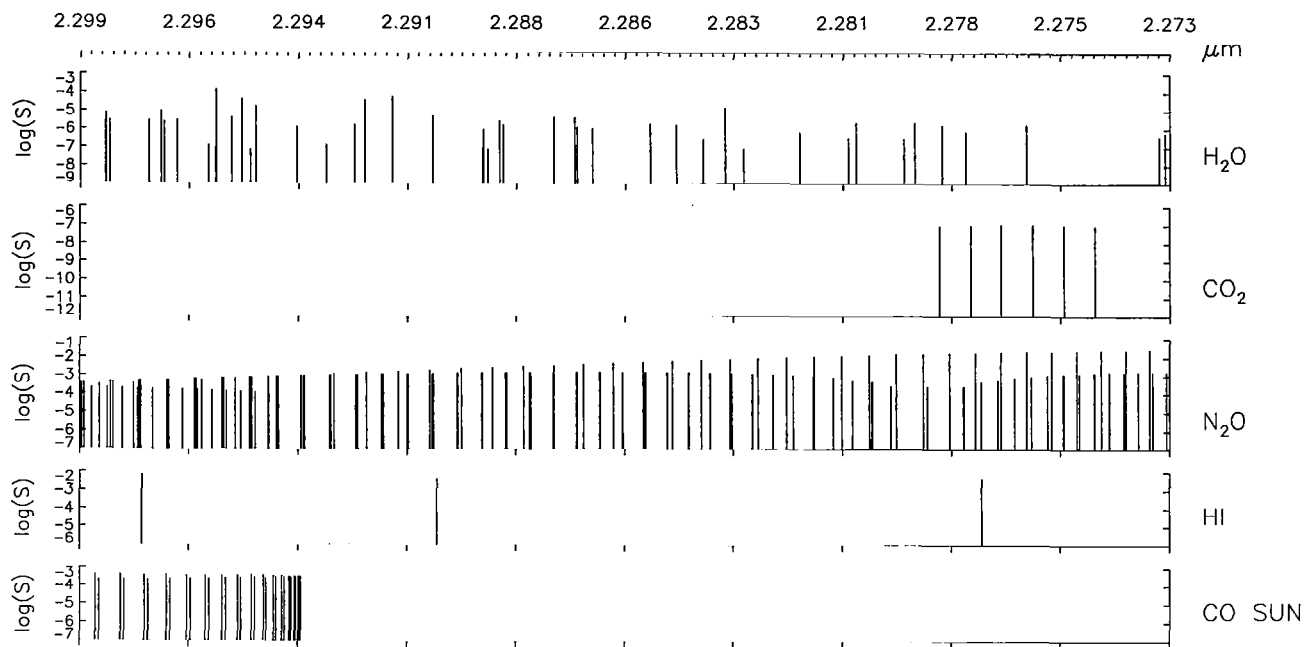


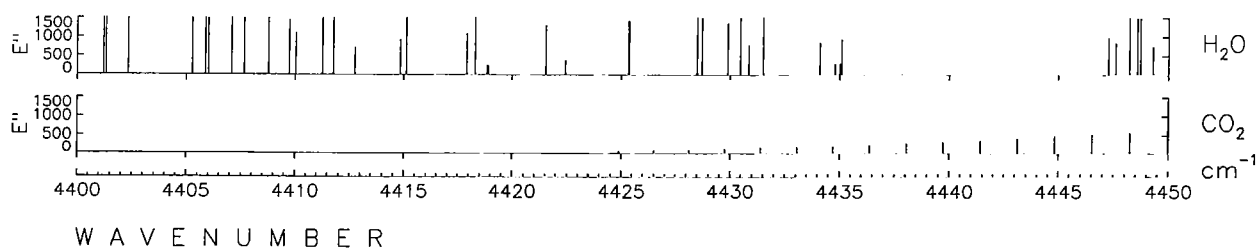
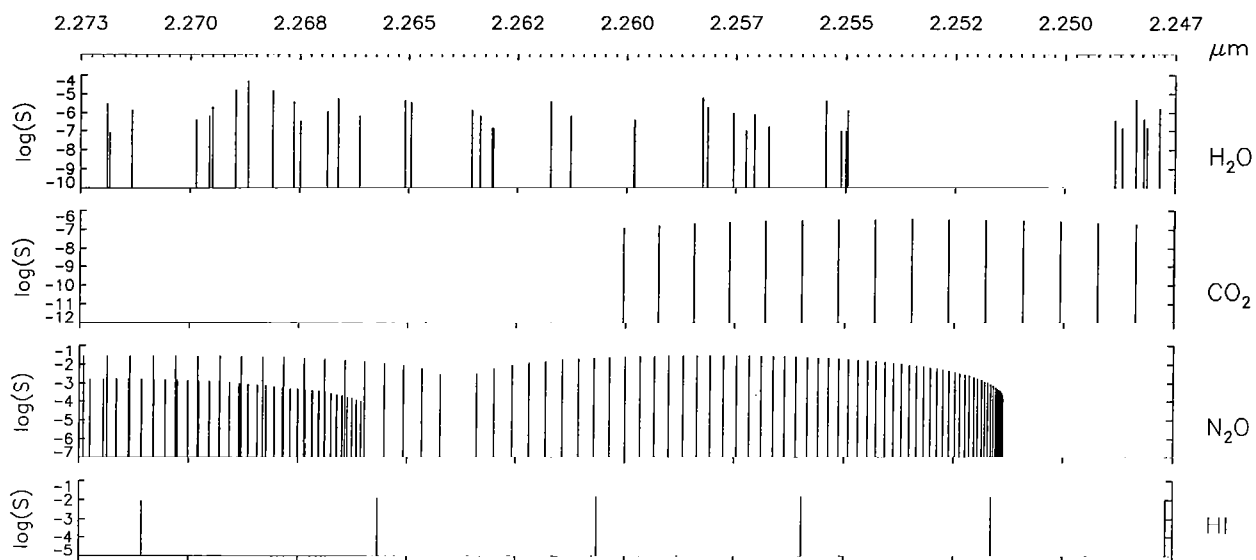


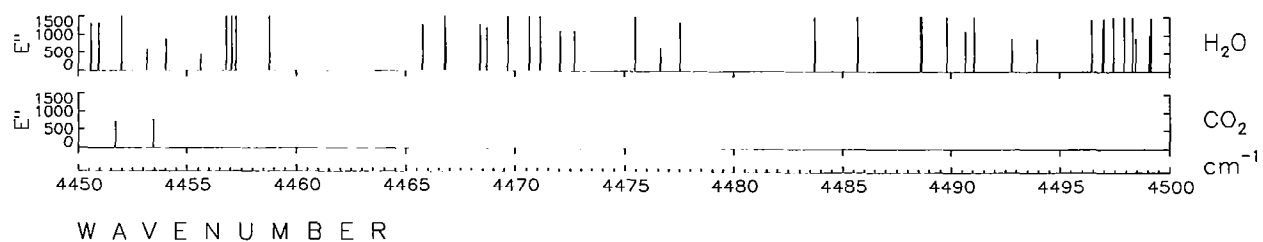
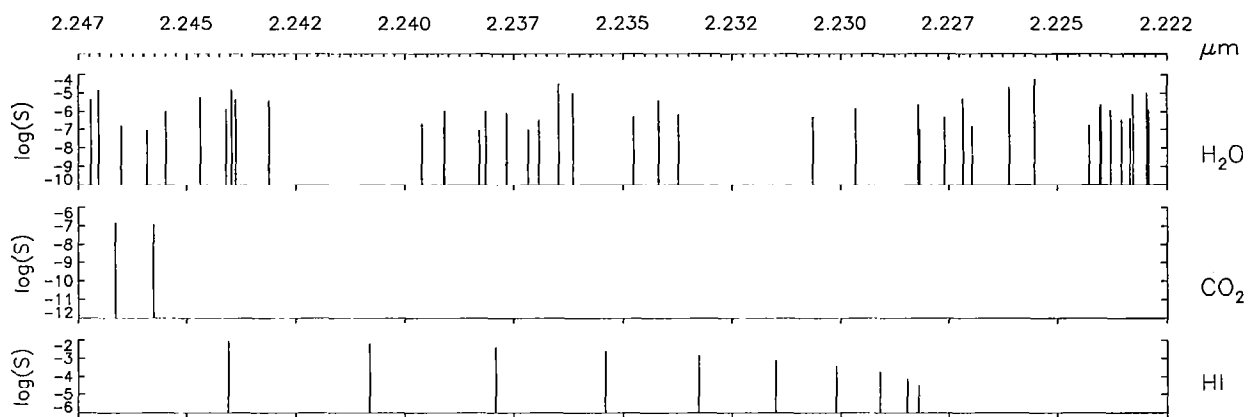


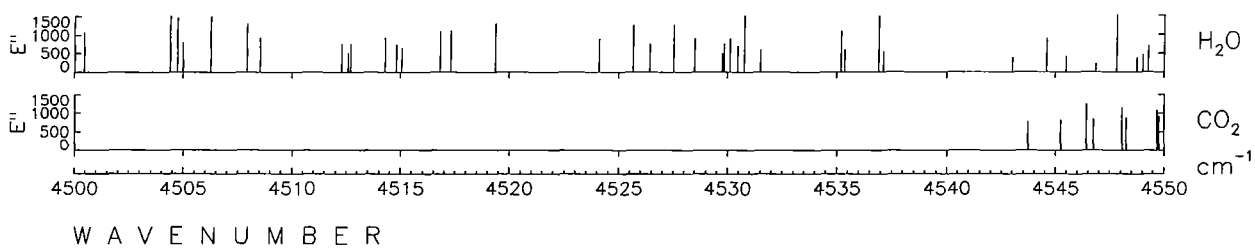
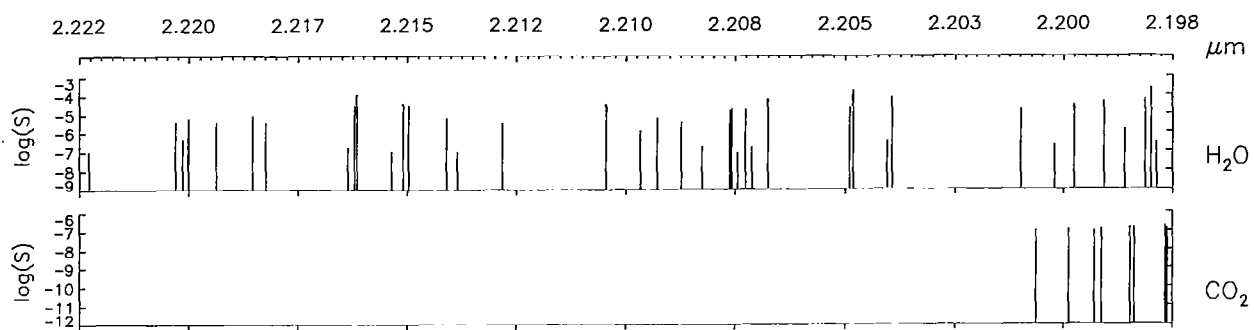


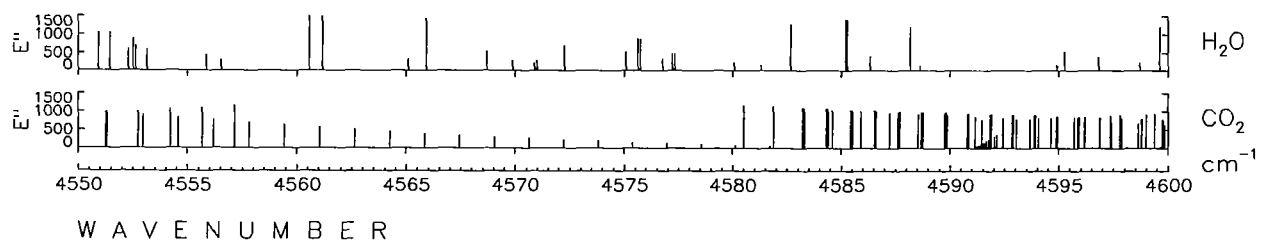
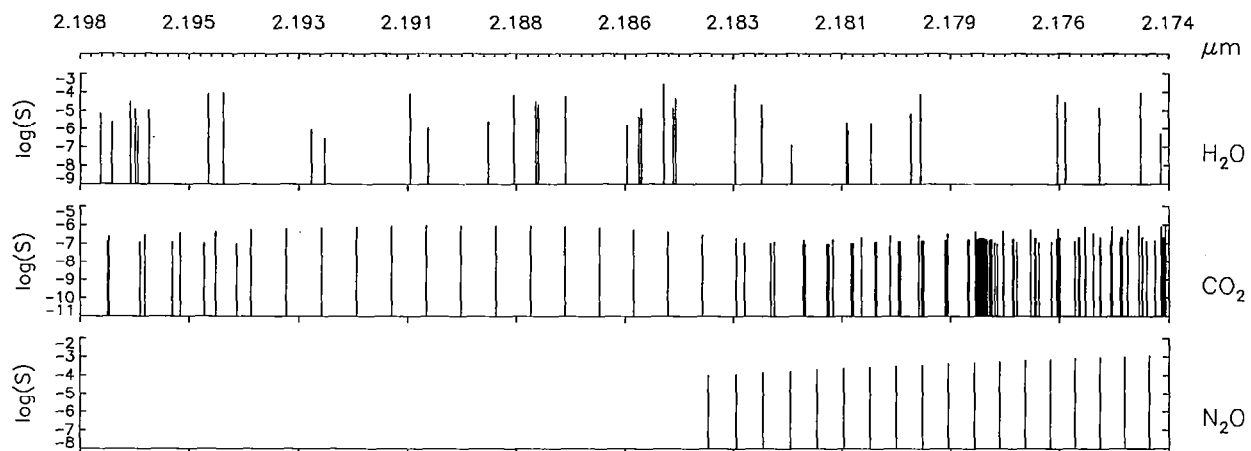


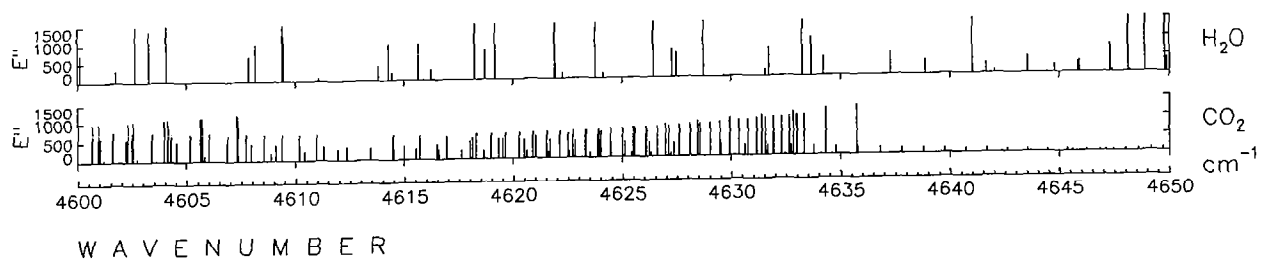
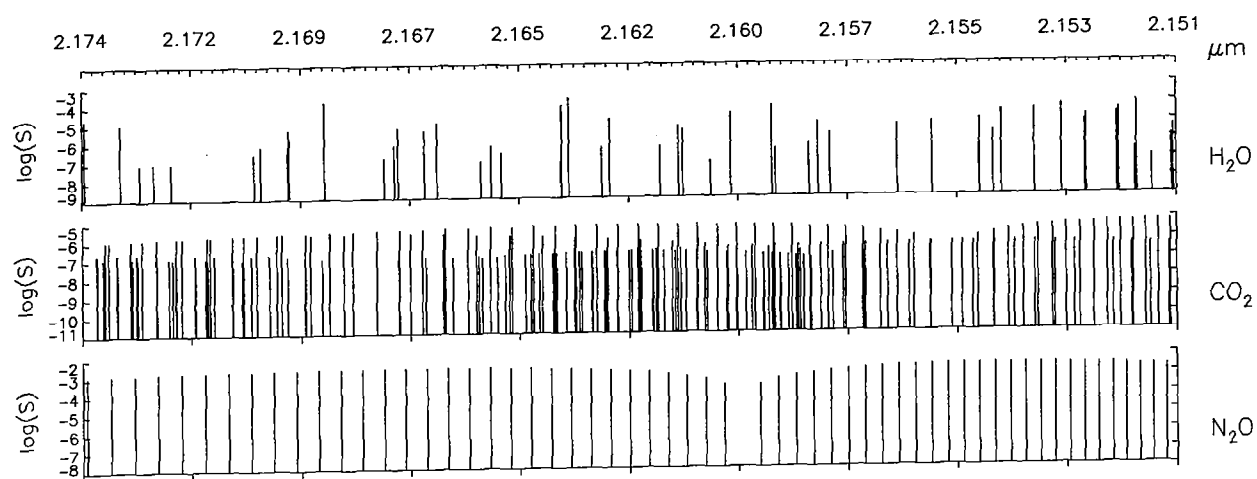


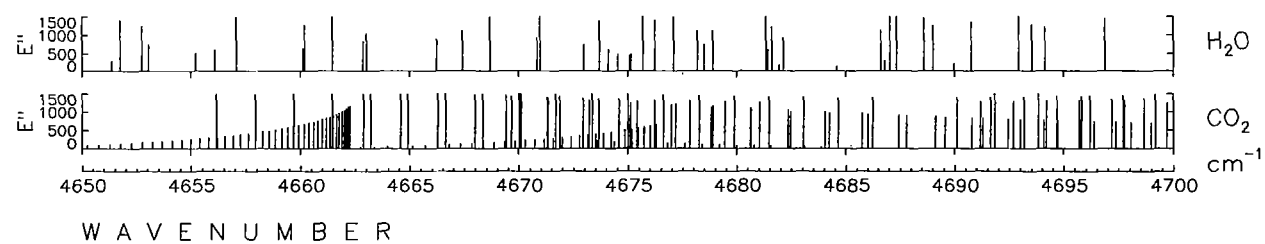
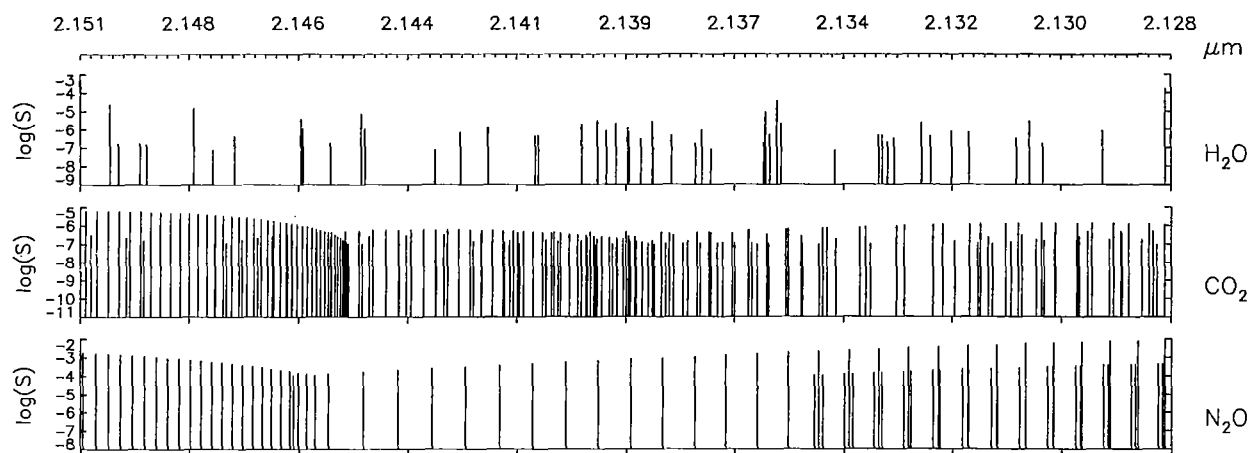




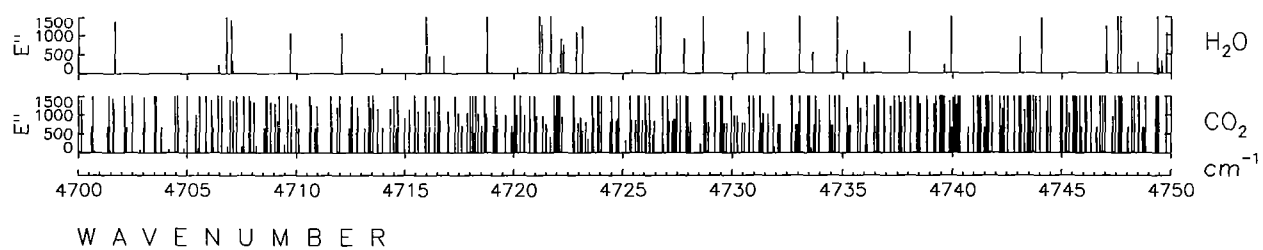
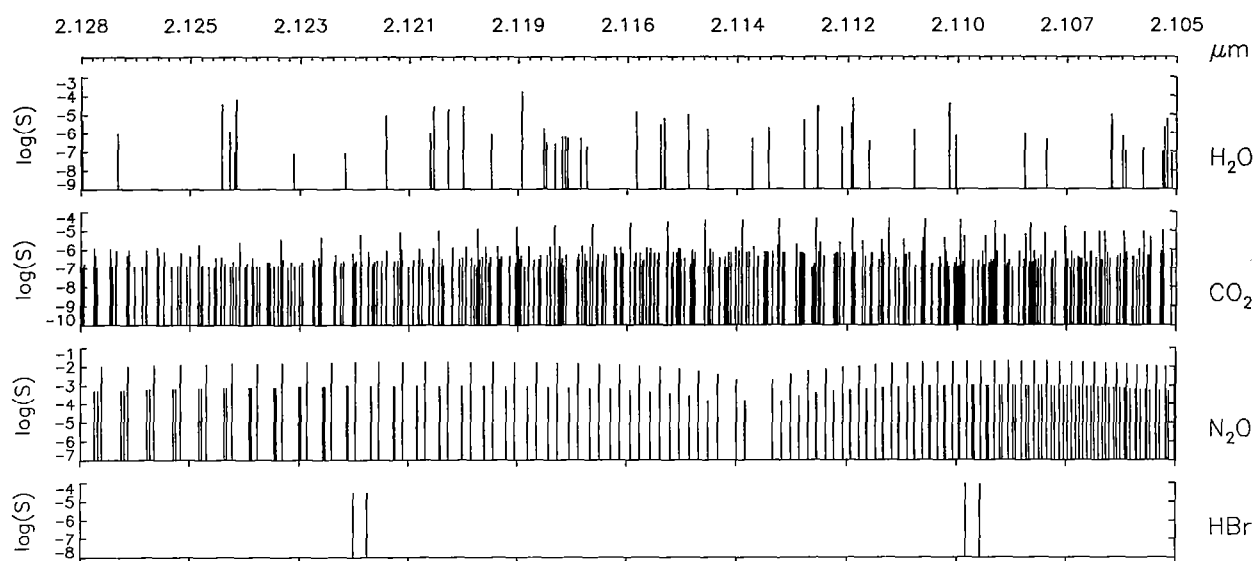


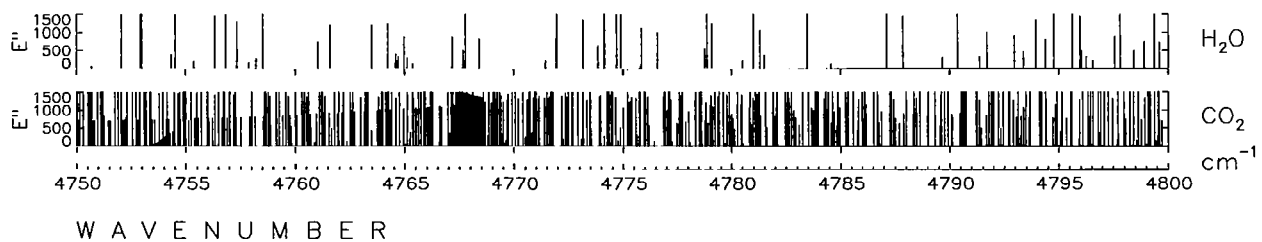
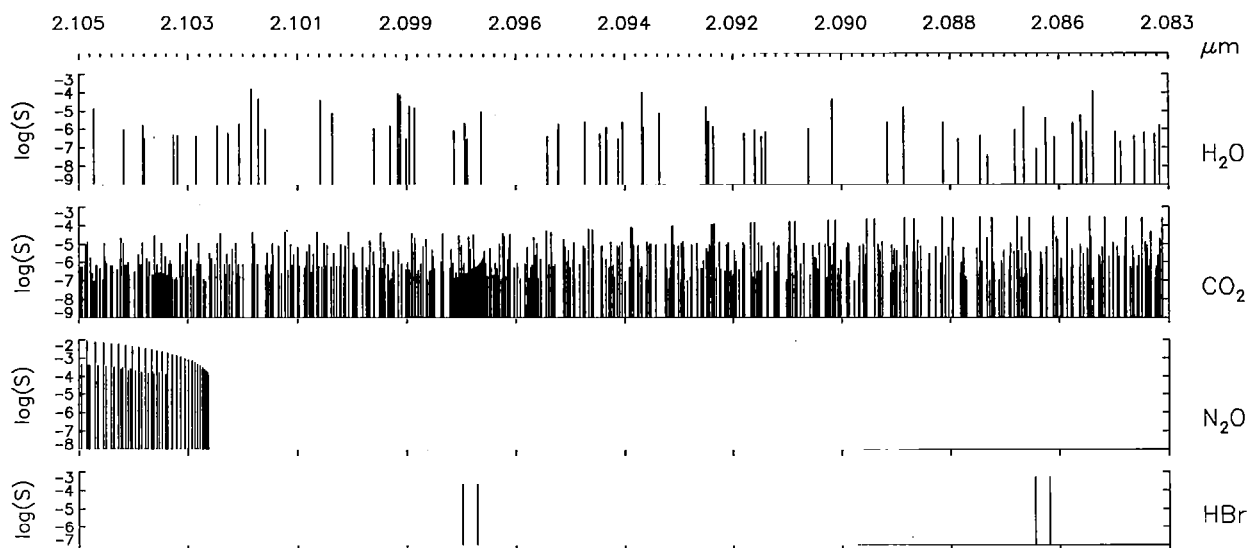


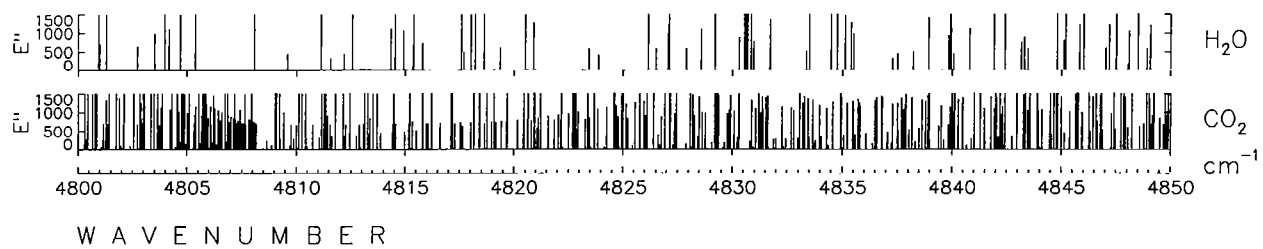
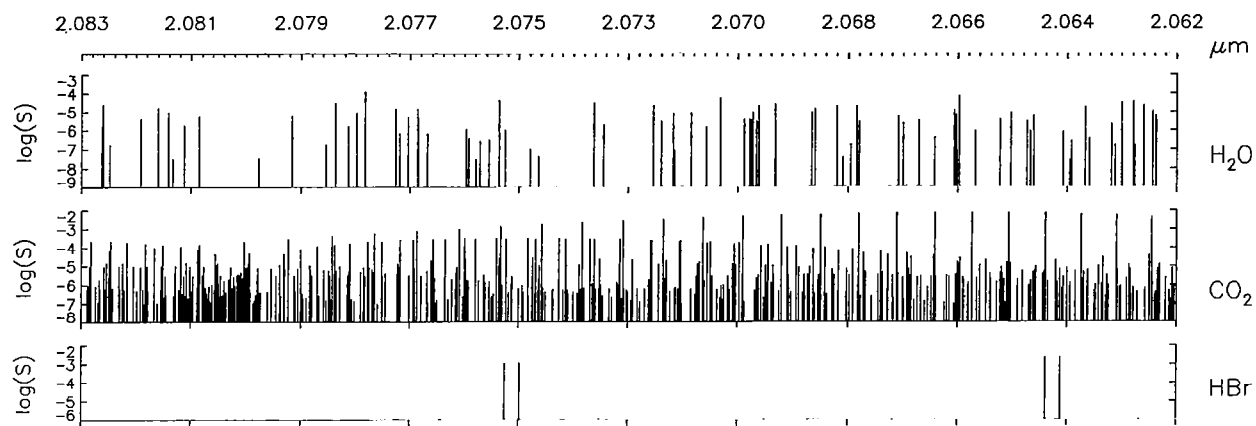


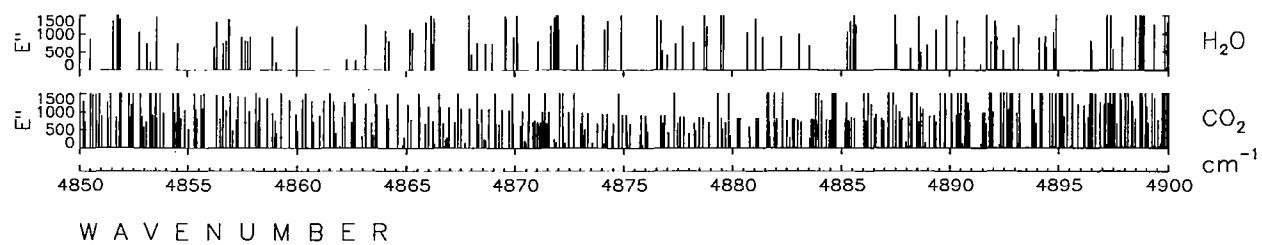
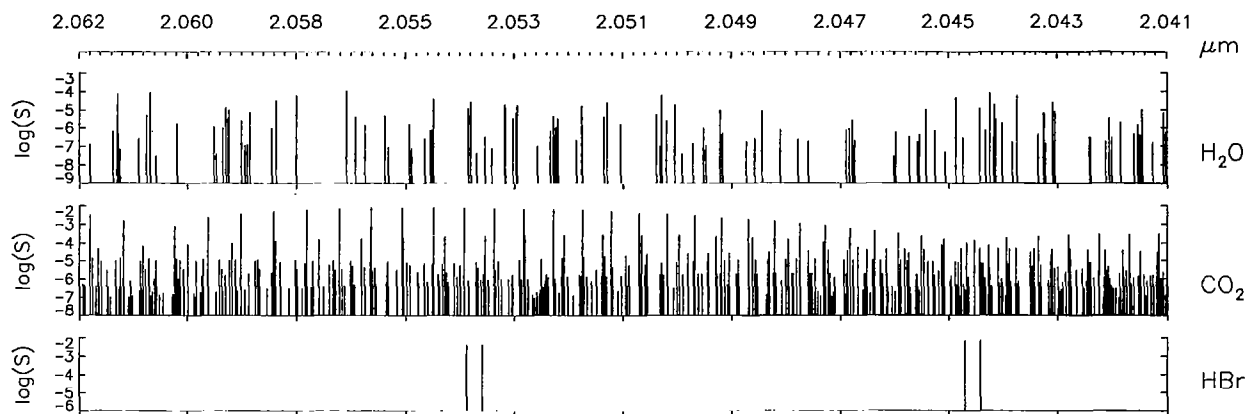


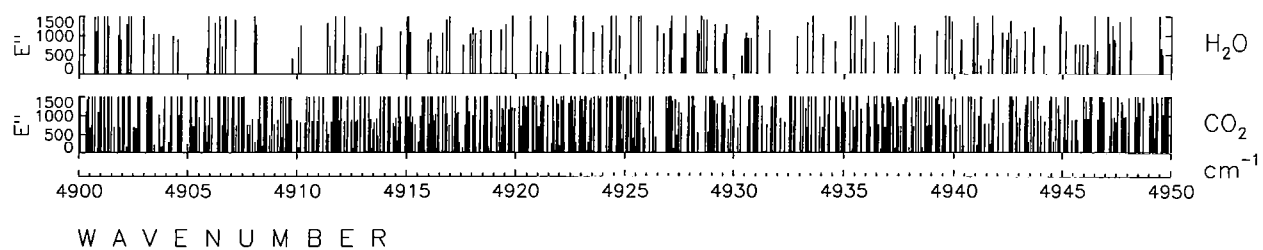
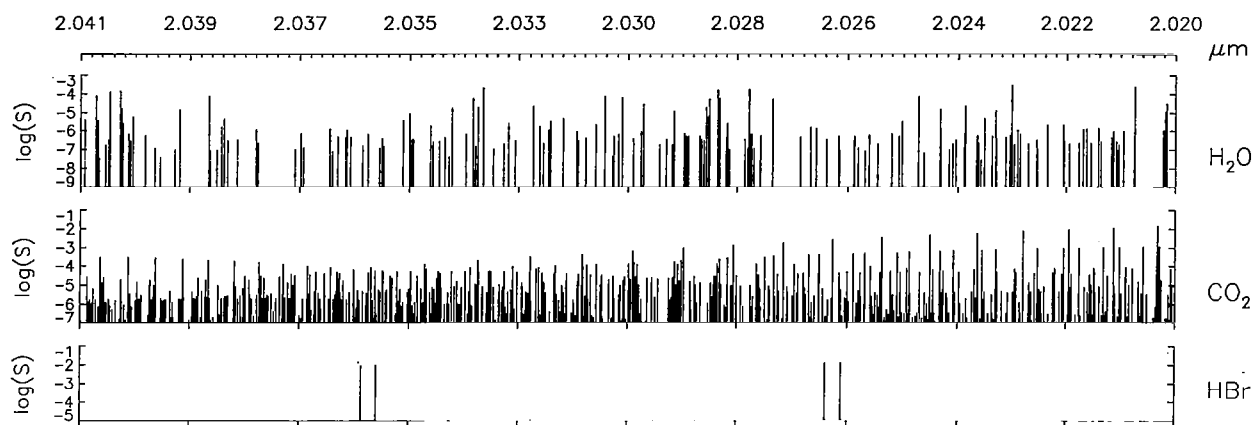


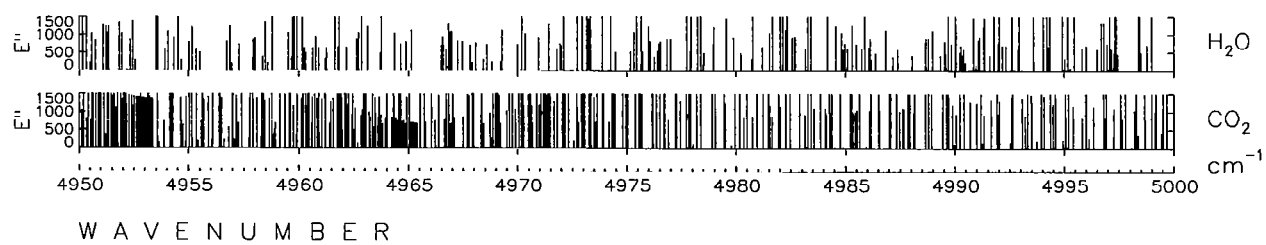
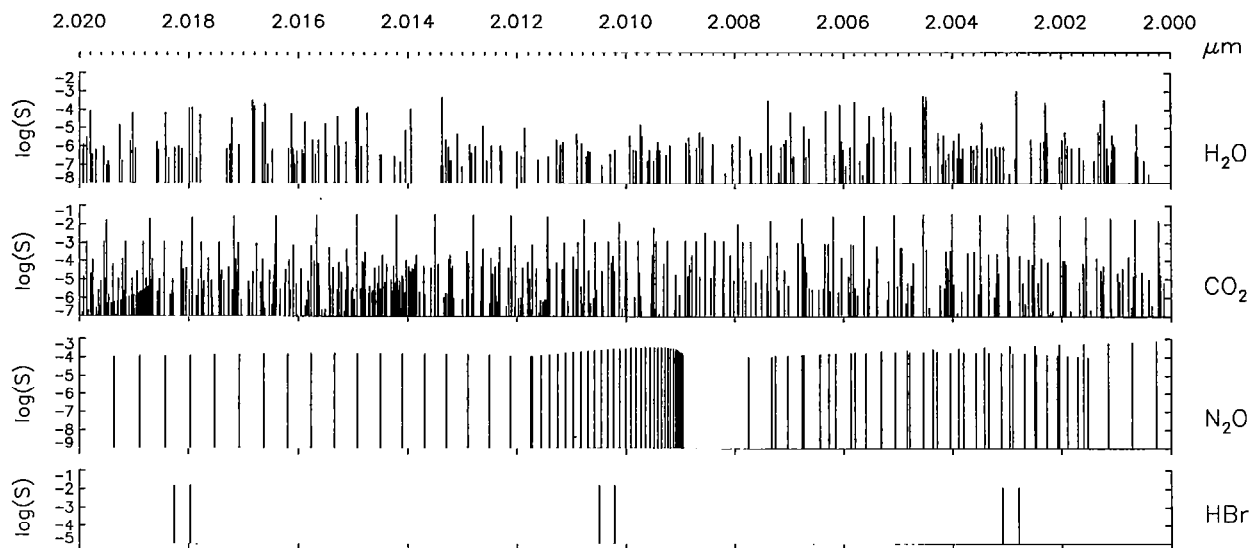


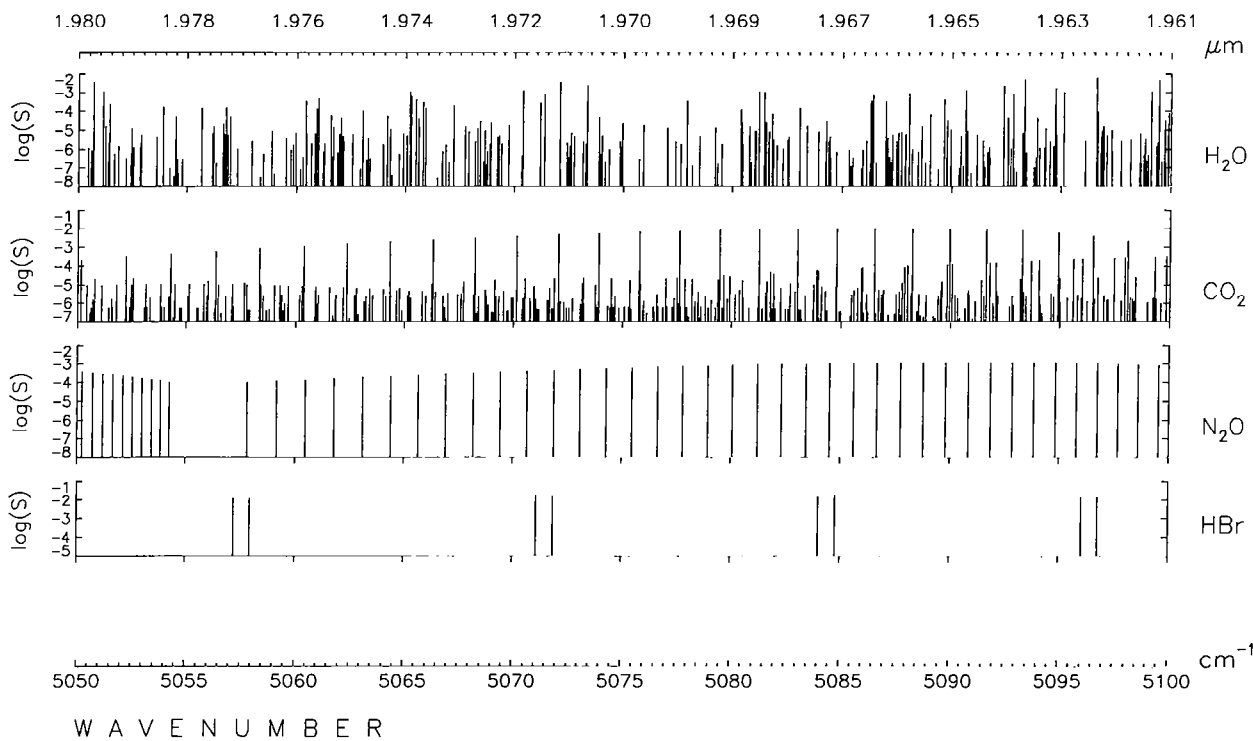
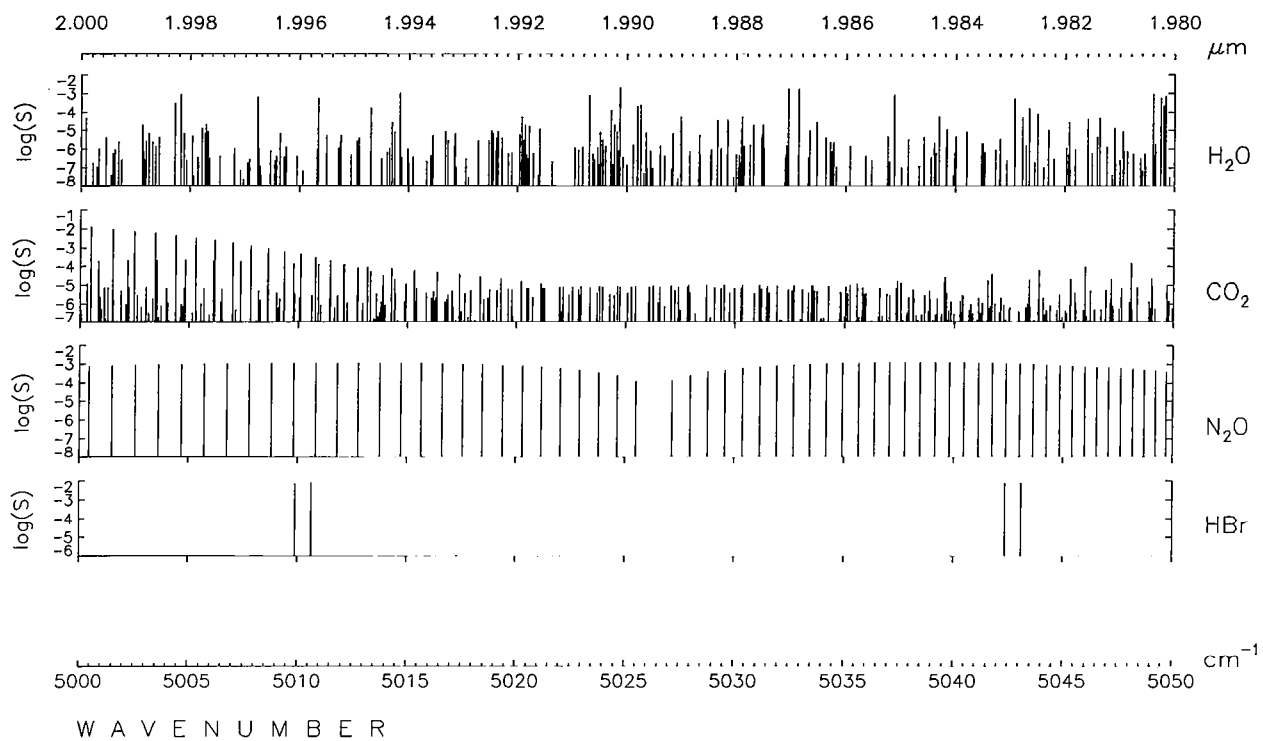


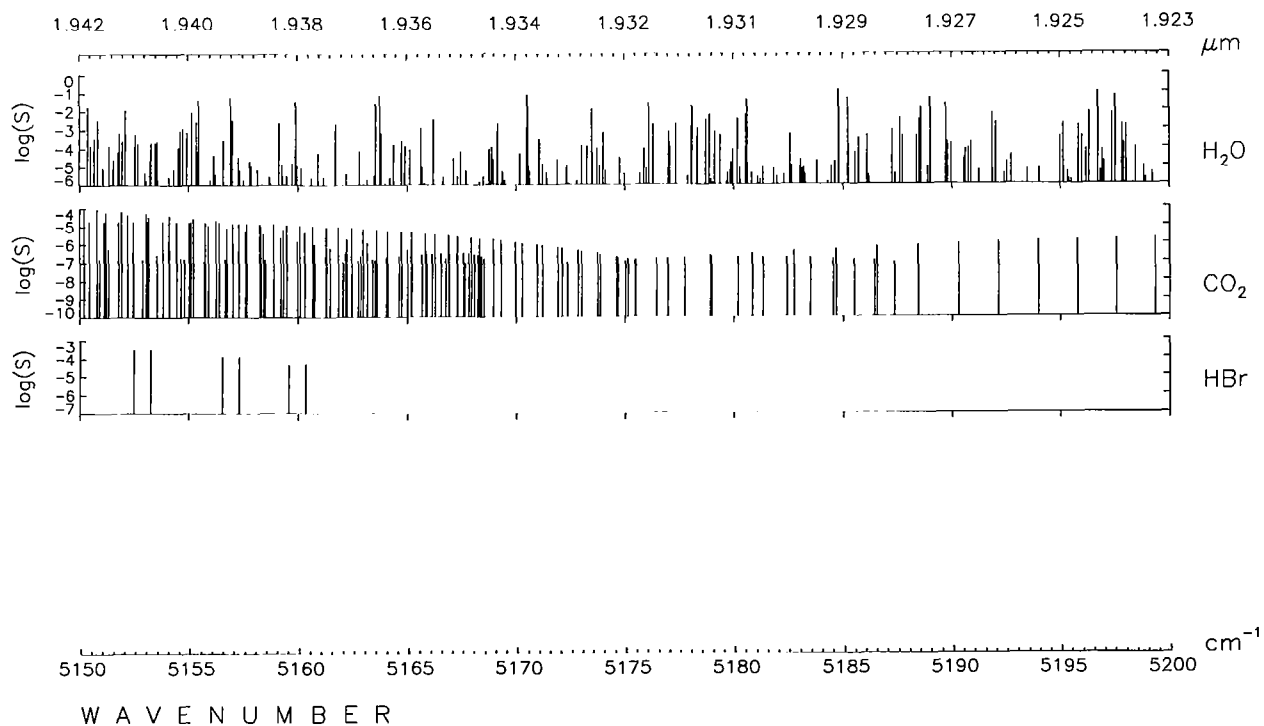
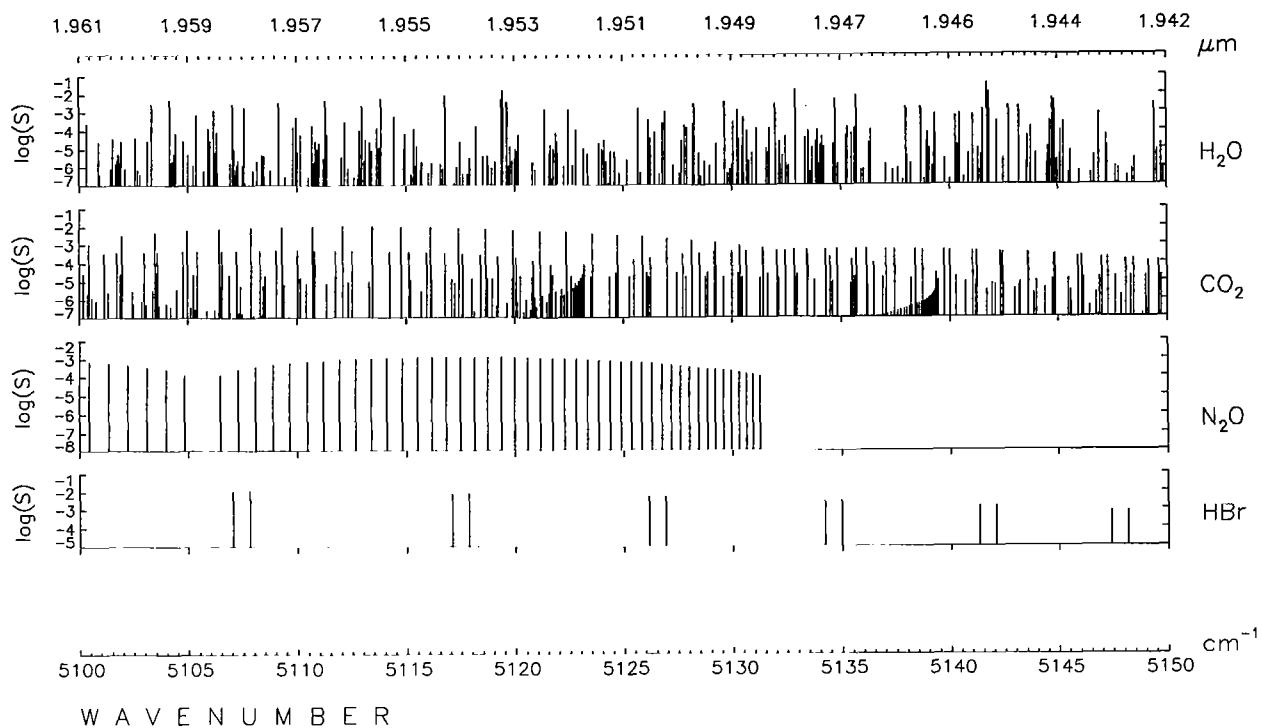




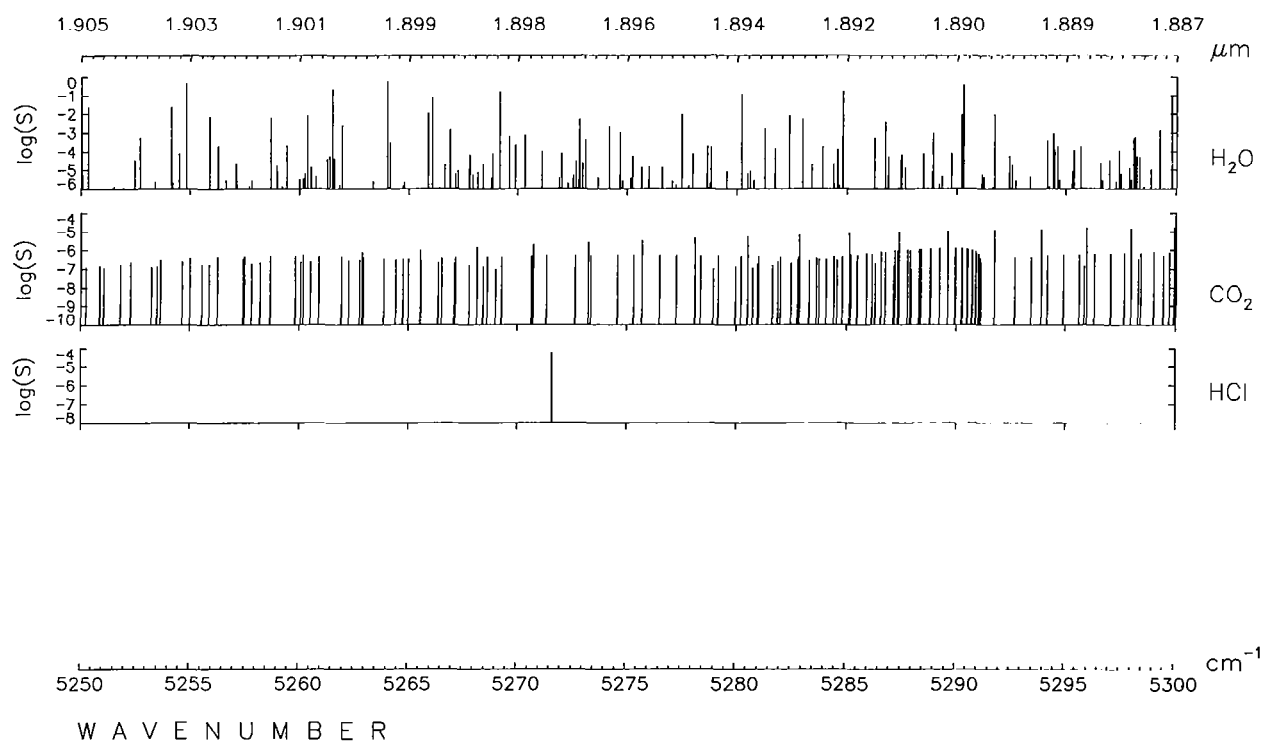
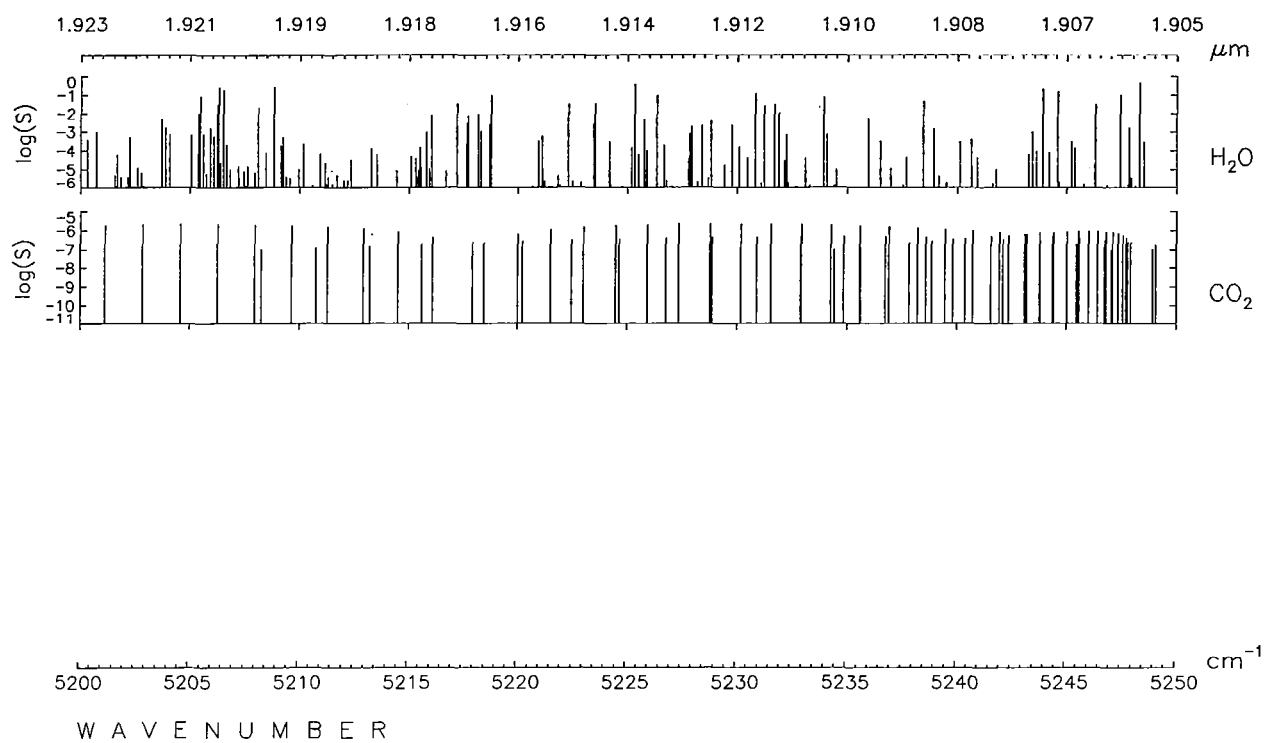


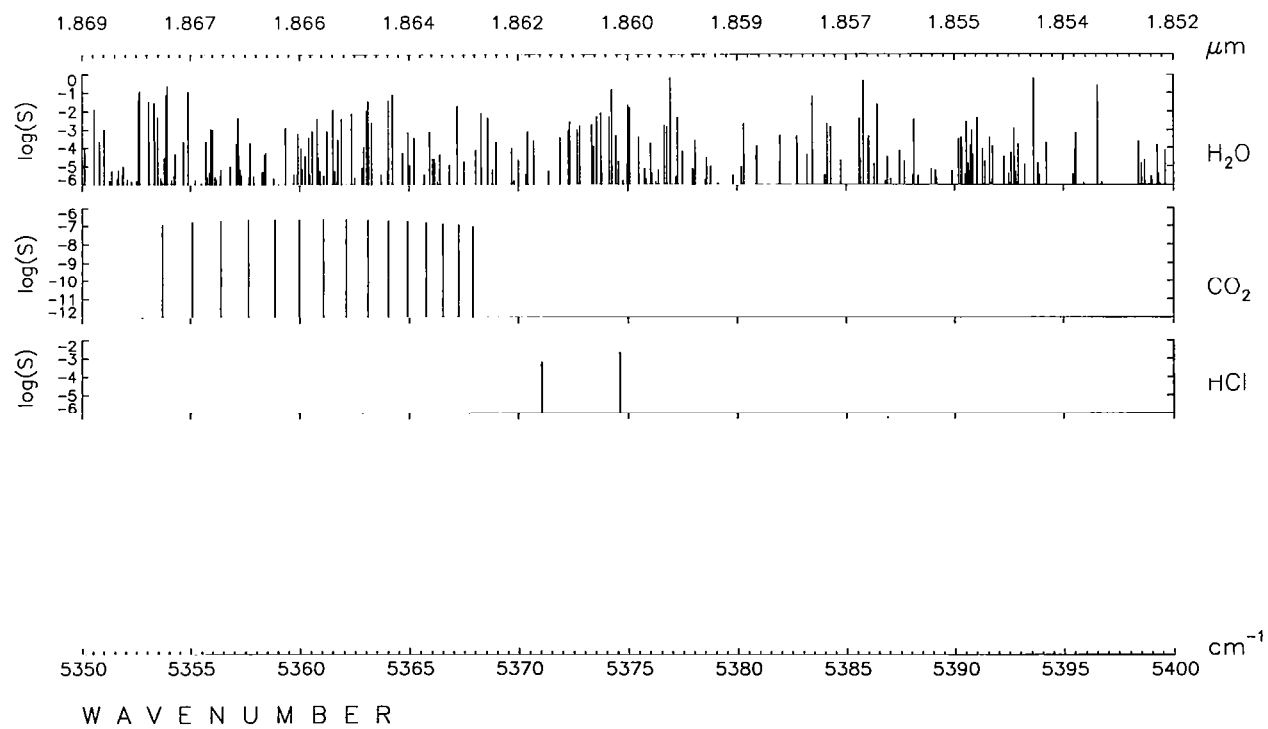
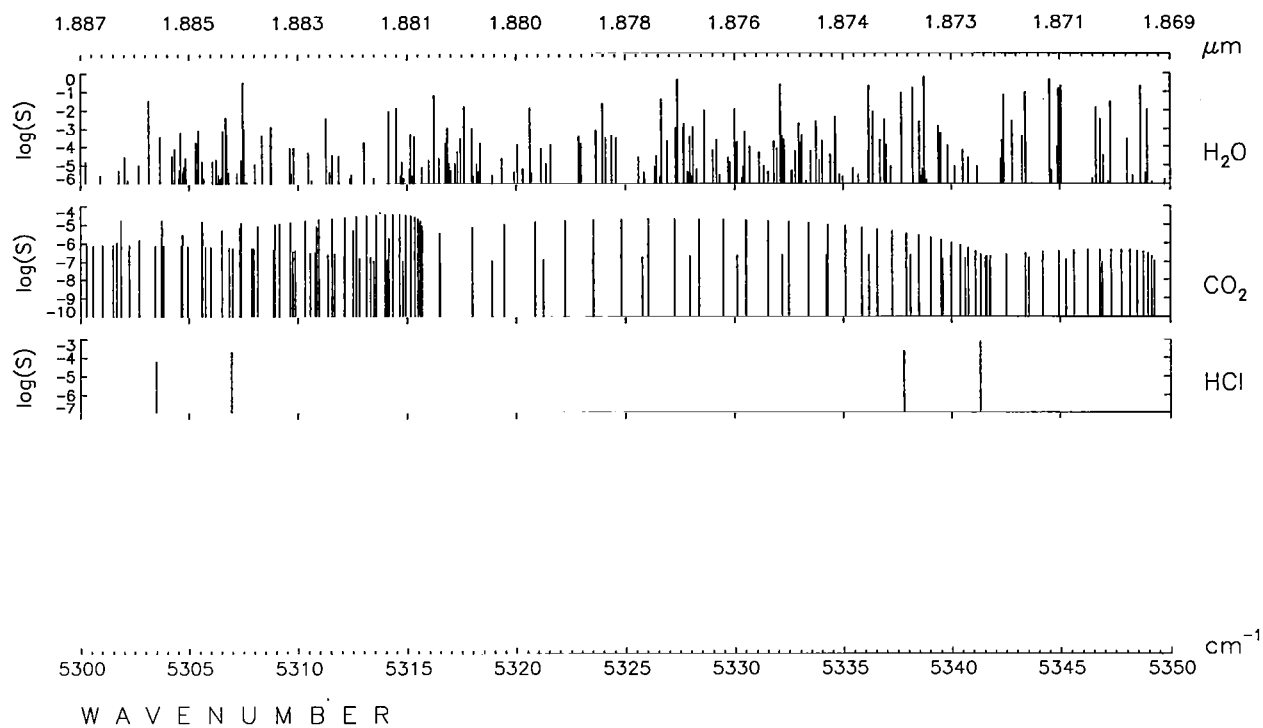


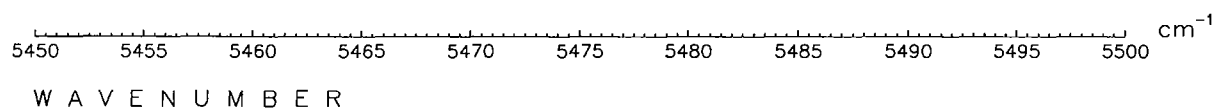
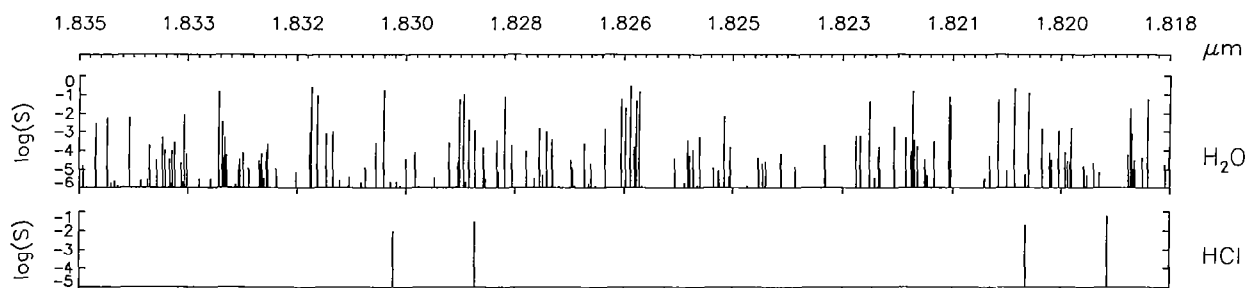
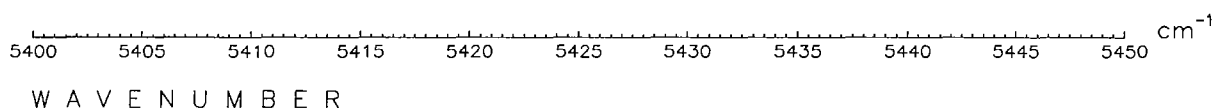
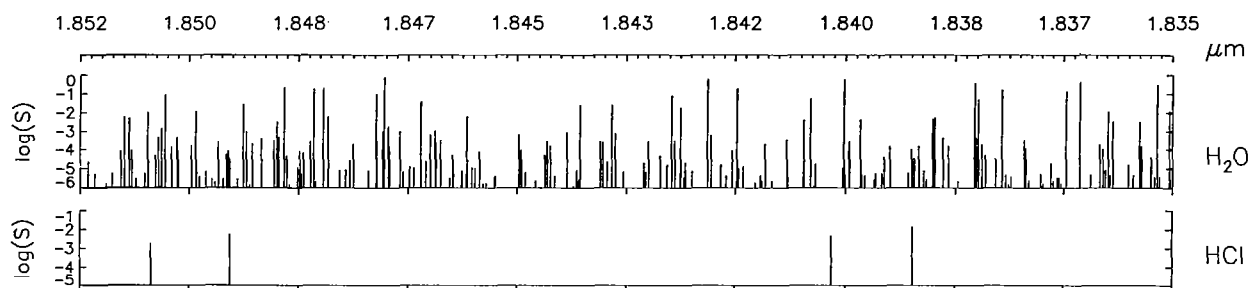


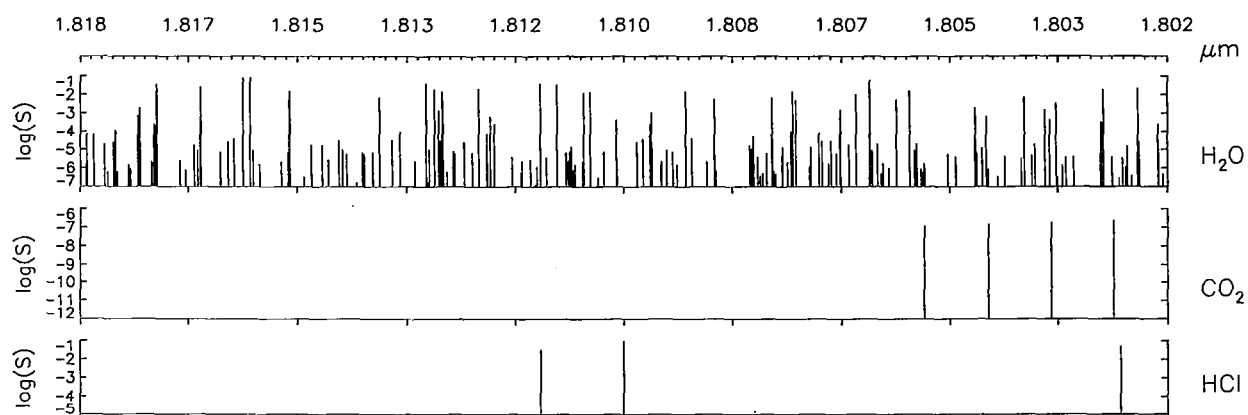




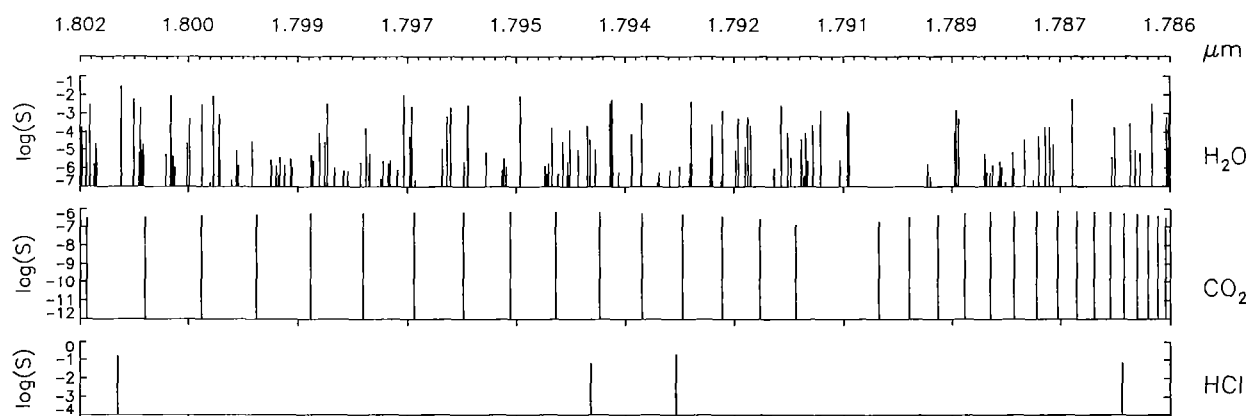




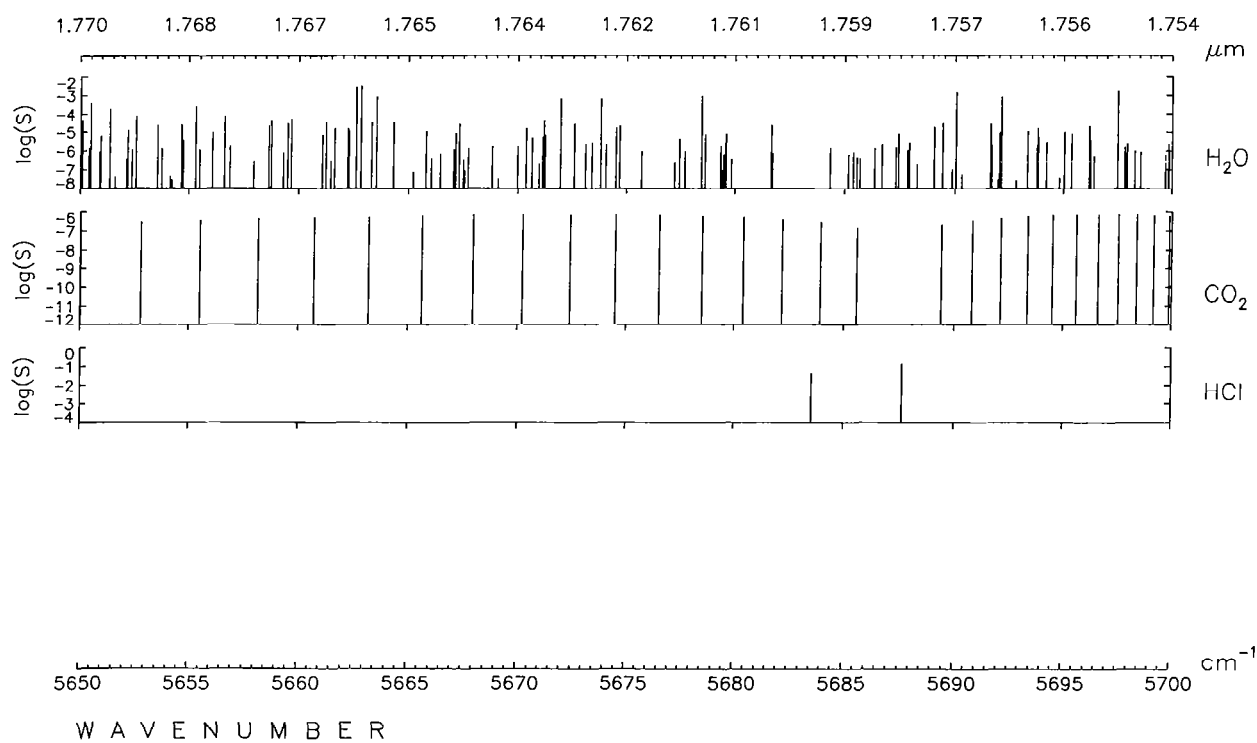
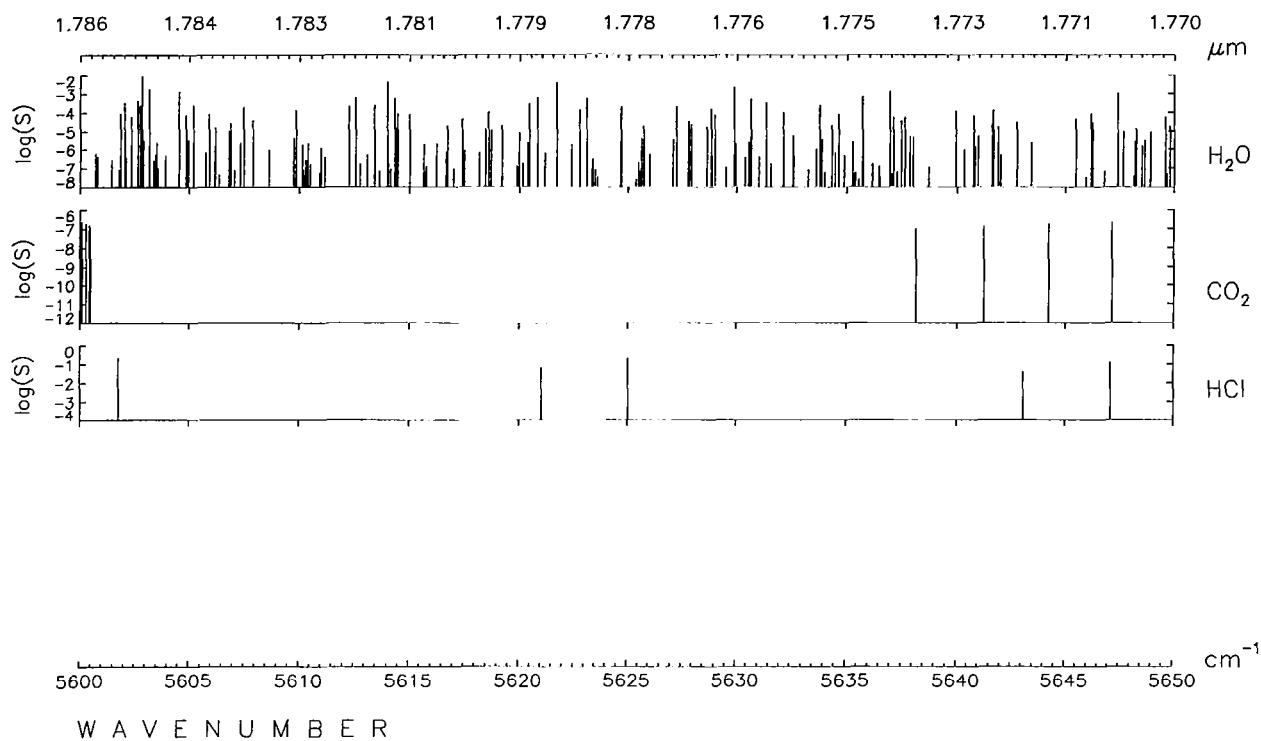


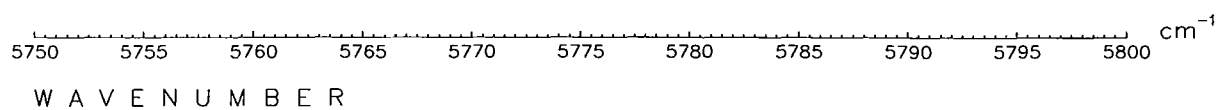
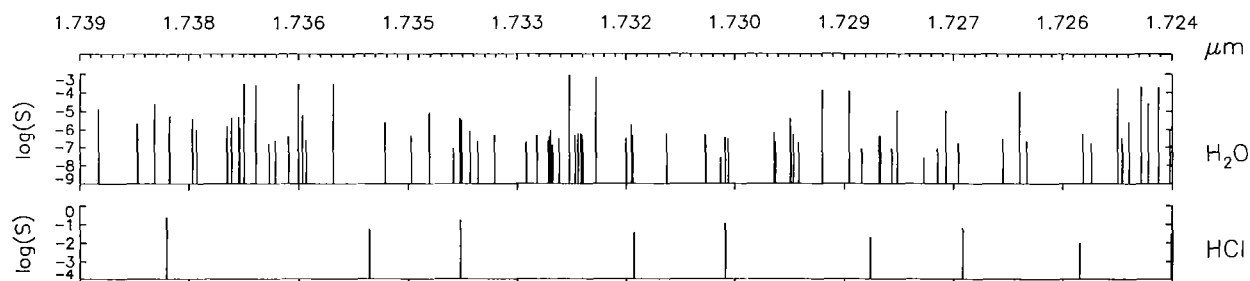
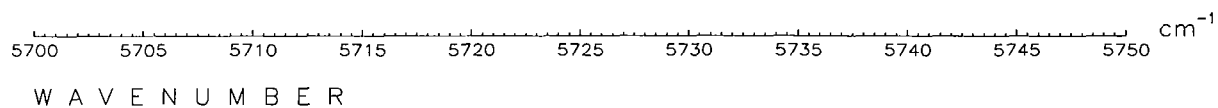
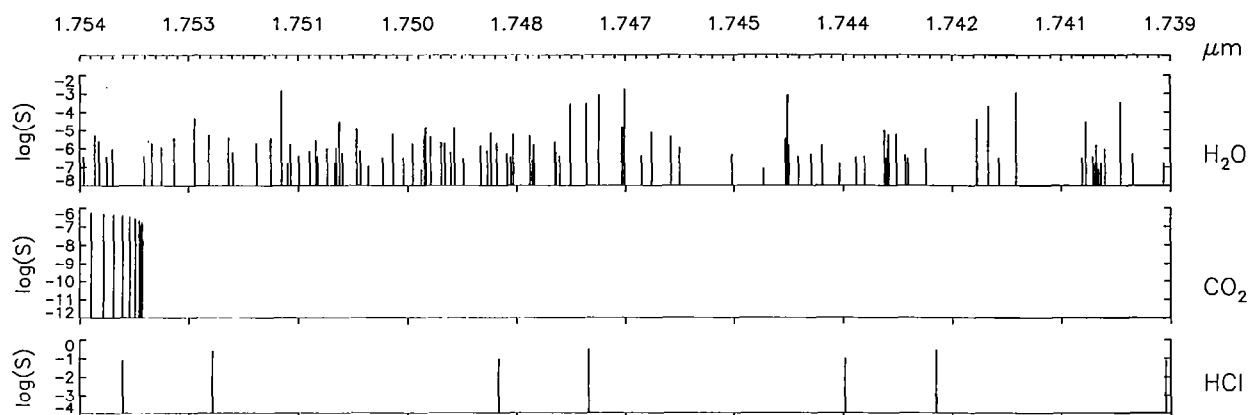


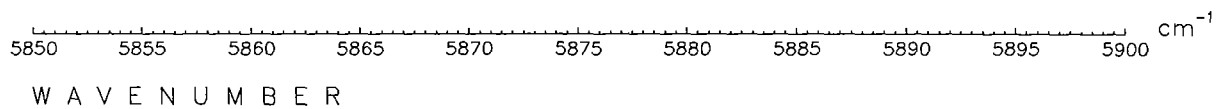
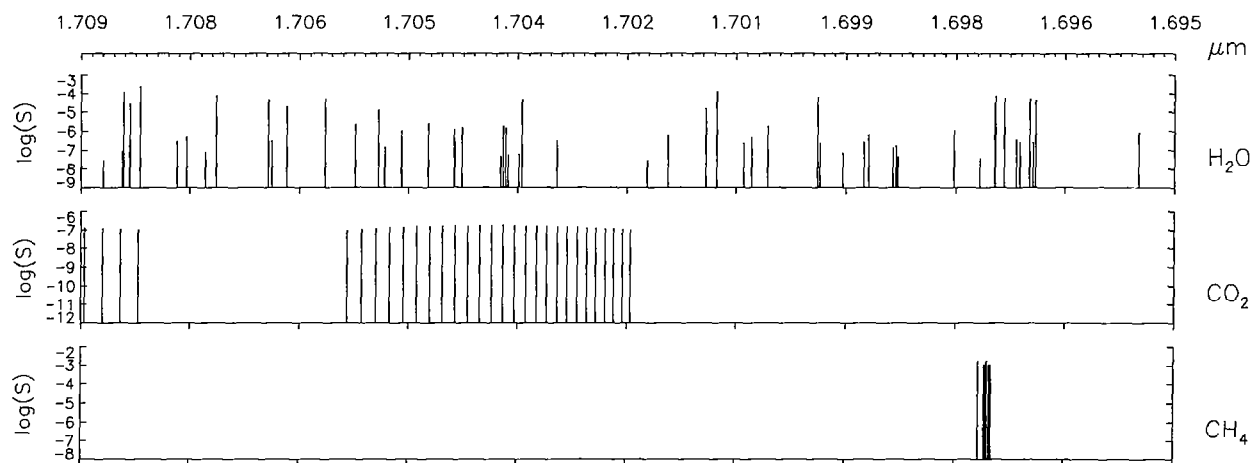
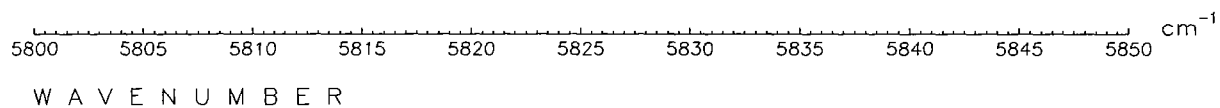
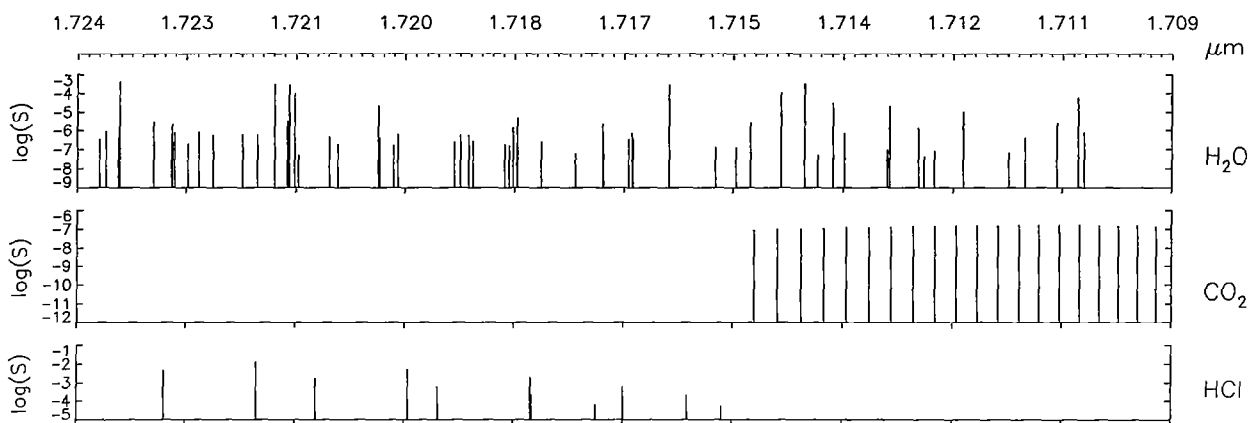
W A V E N U M B E R  $\text{cm}^{-1}$

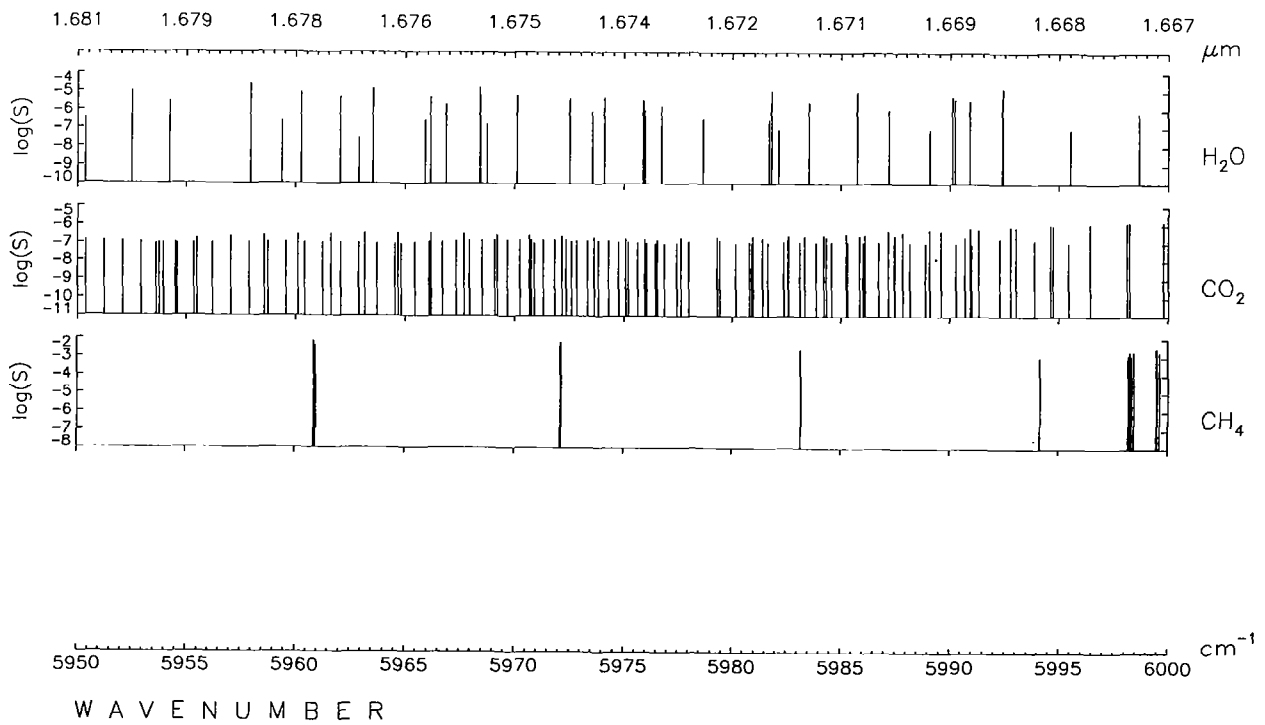
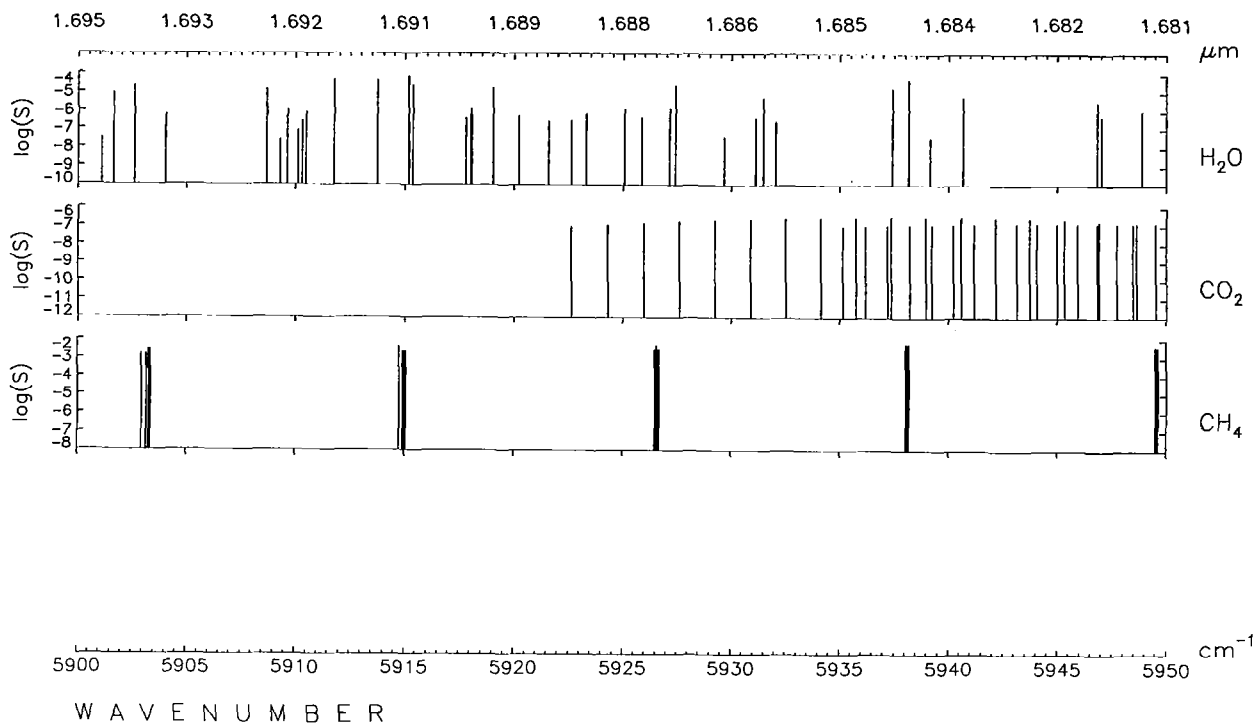


W A V E N U M B E R  $\text{cm}^{-1}$

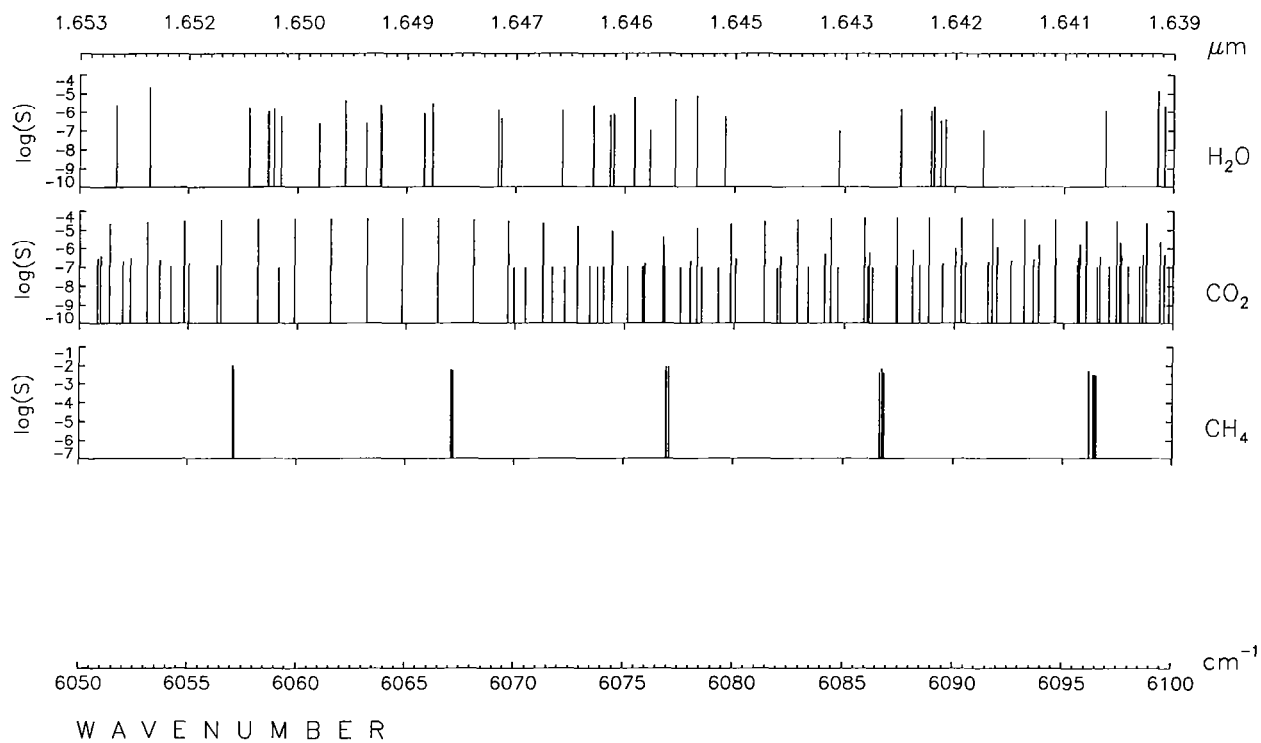
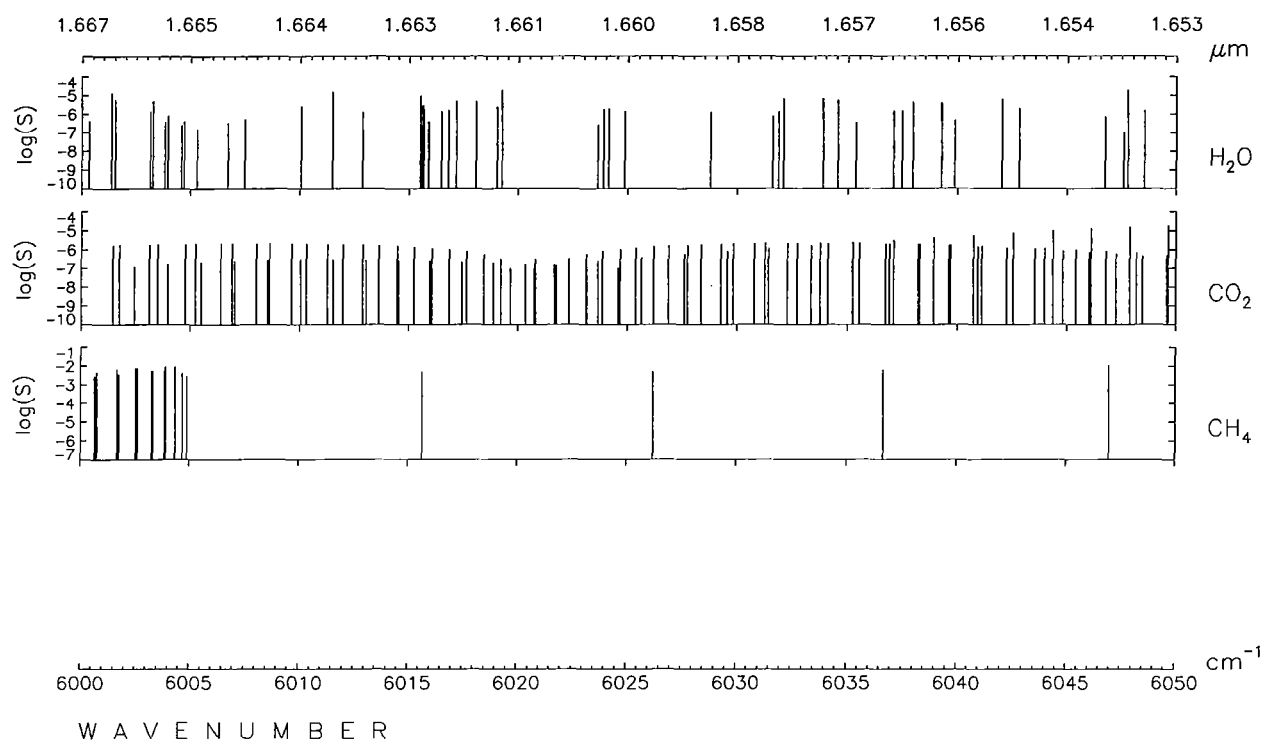


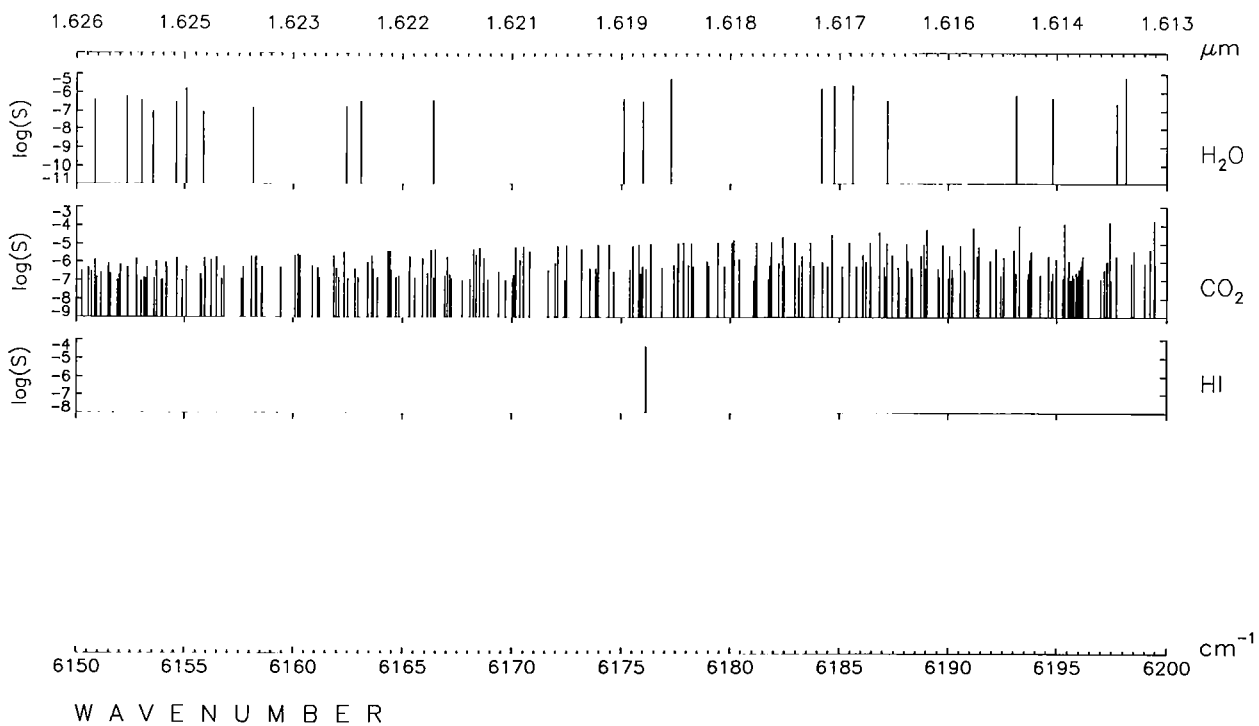
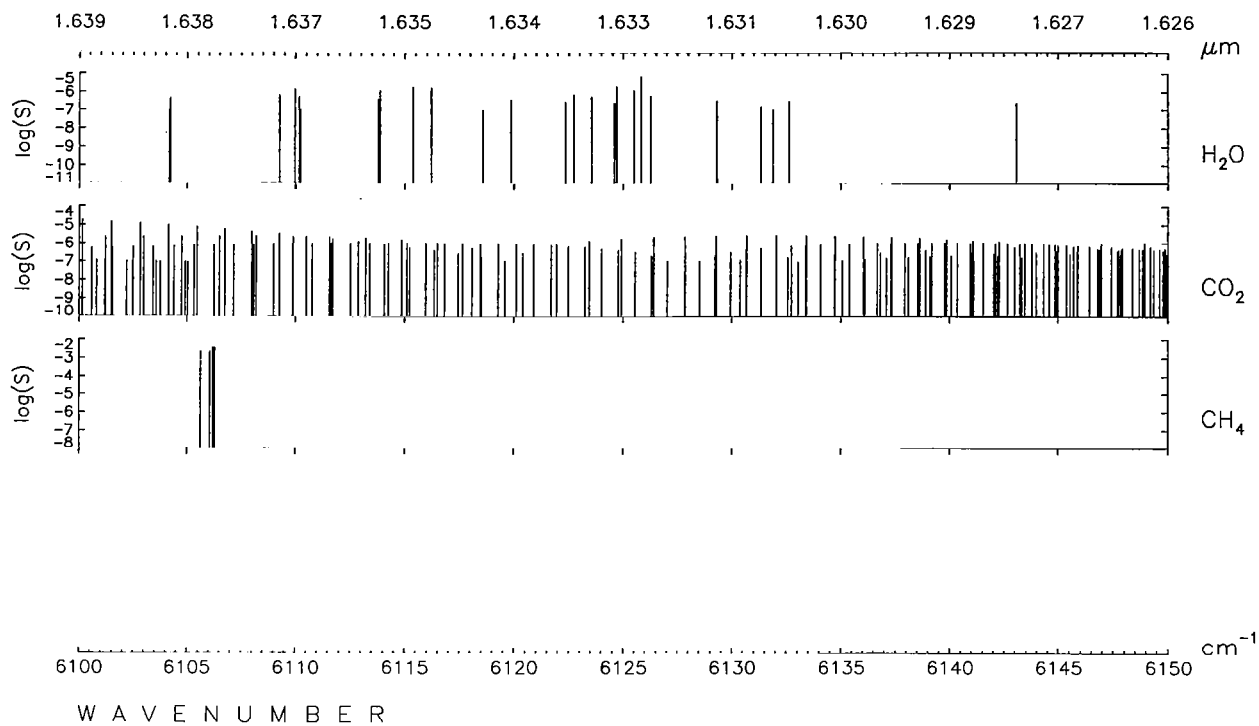


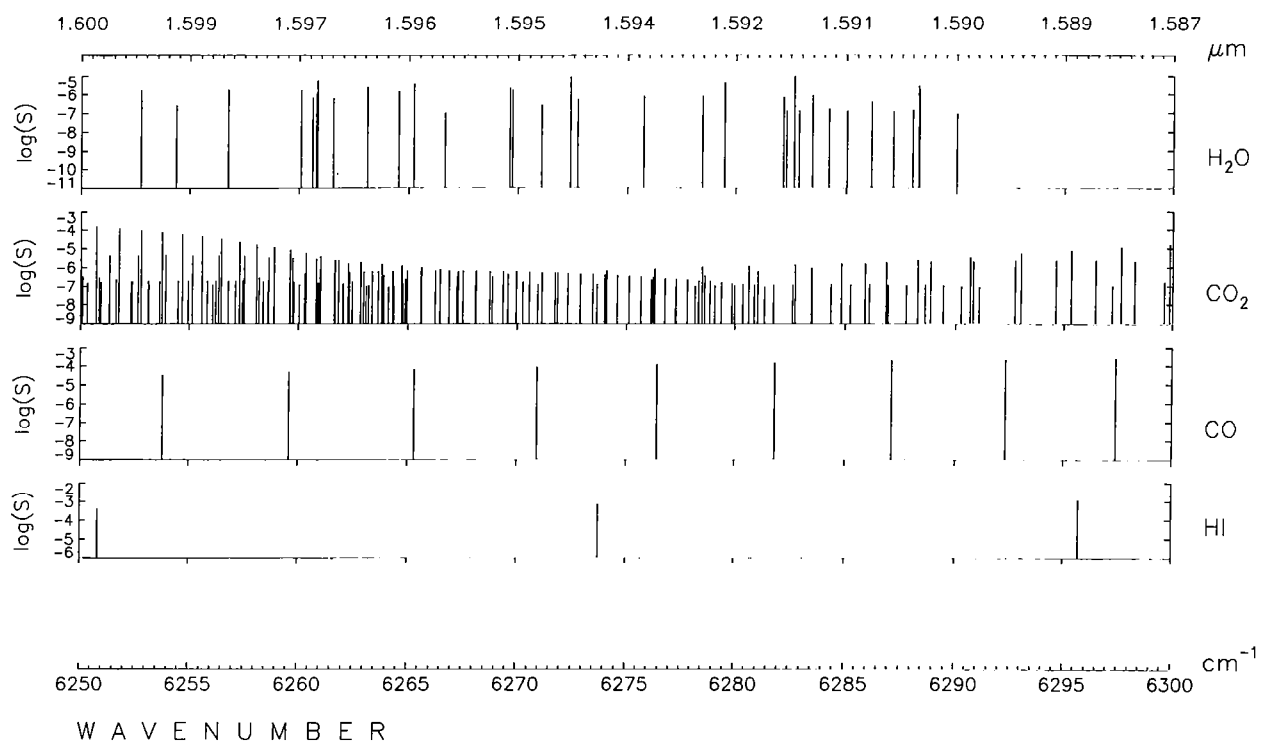
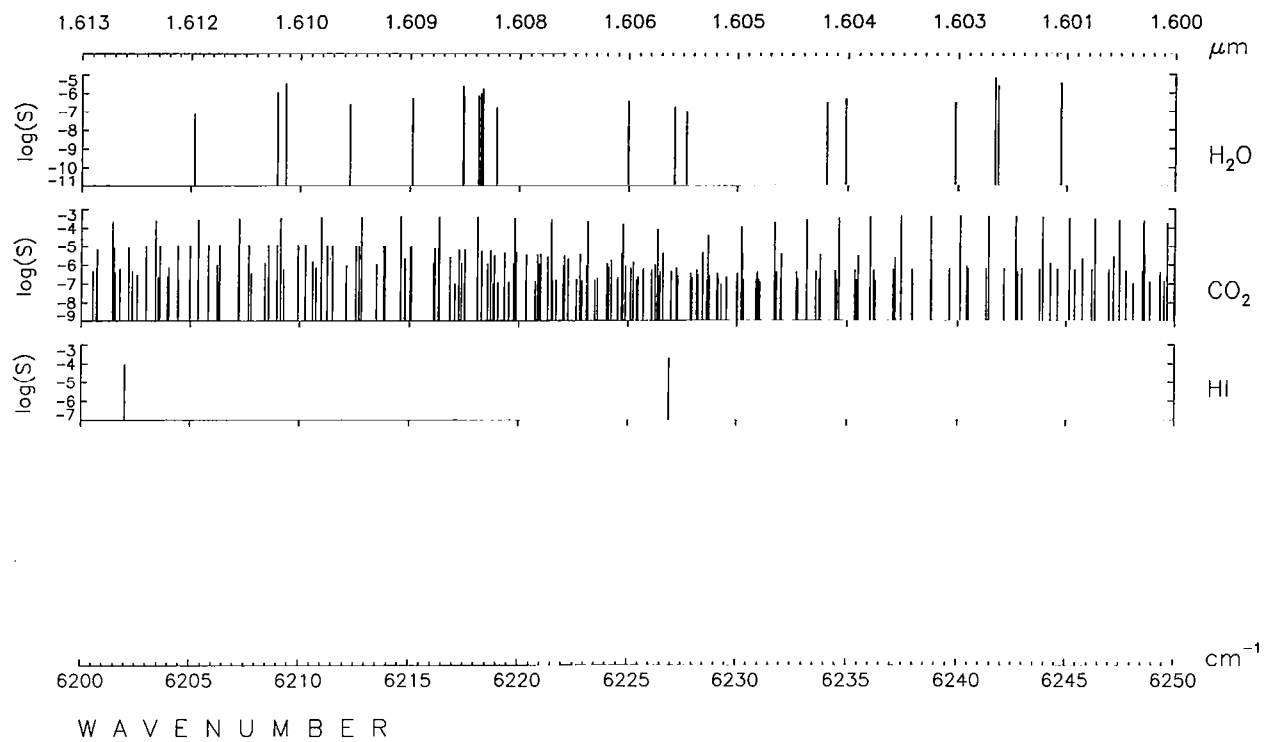


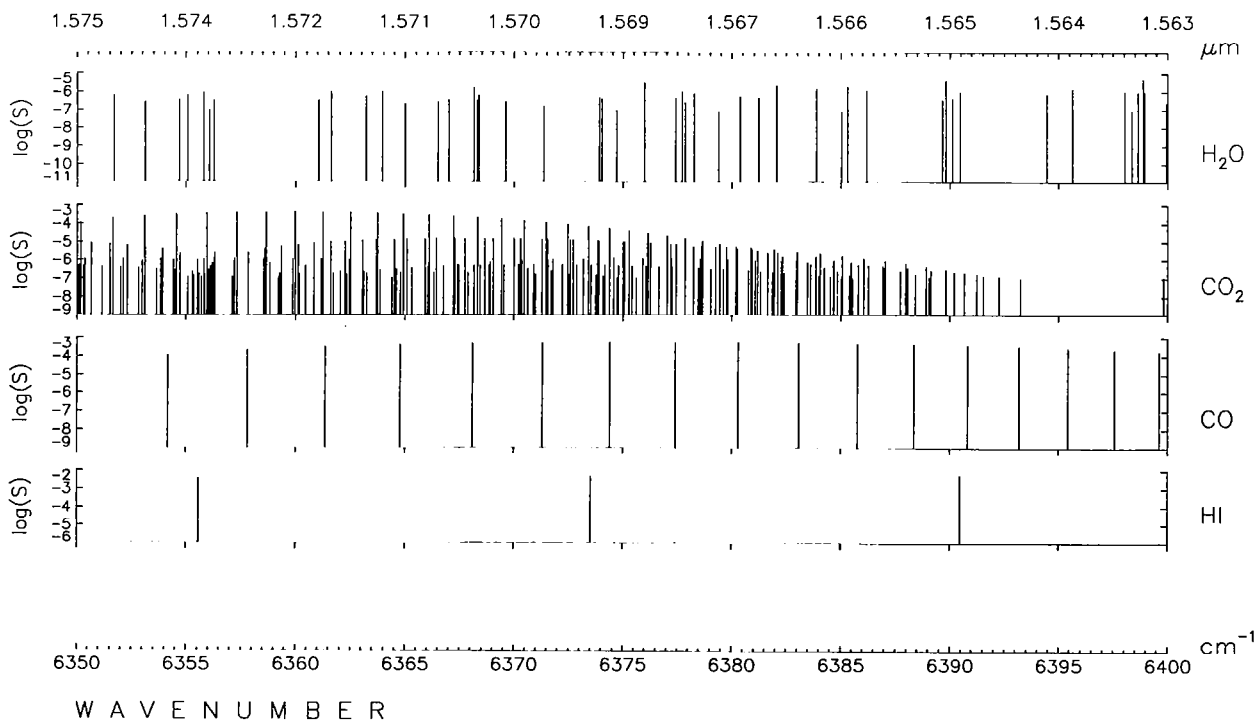
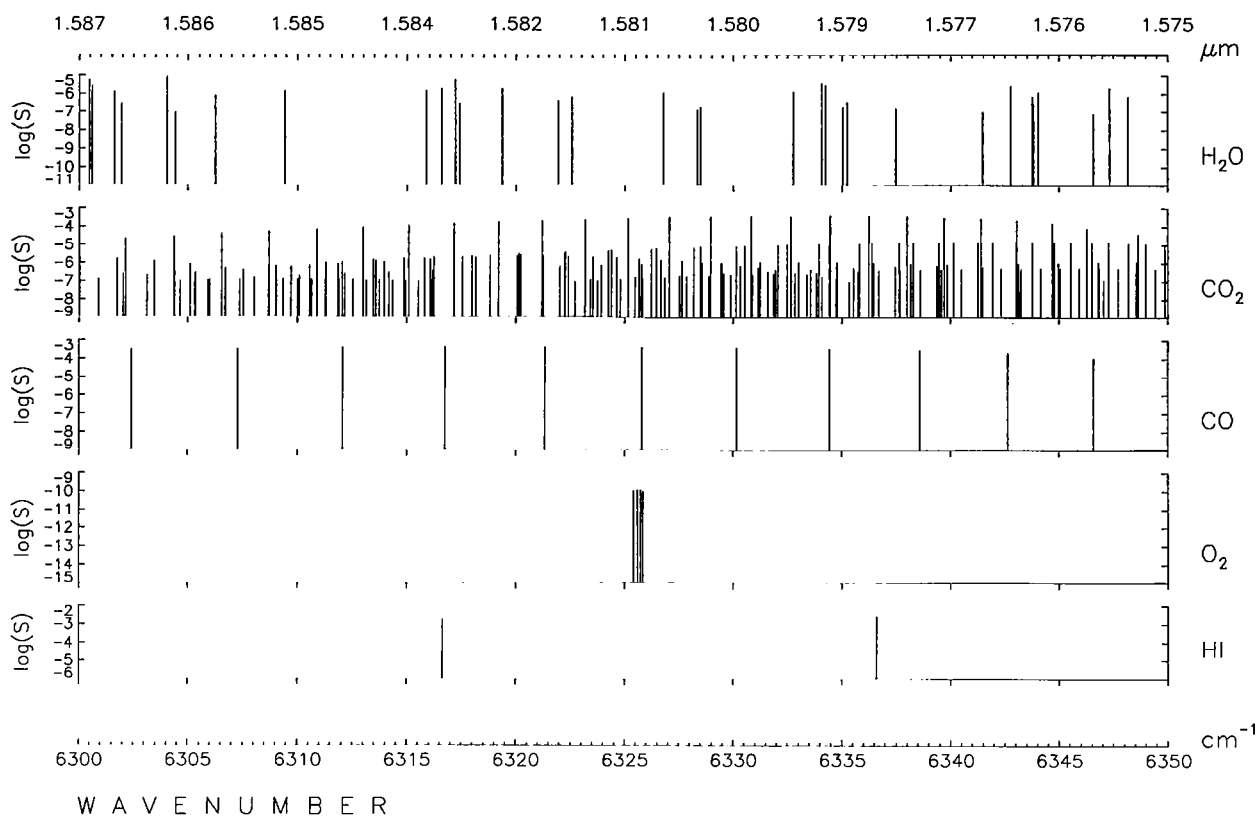


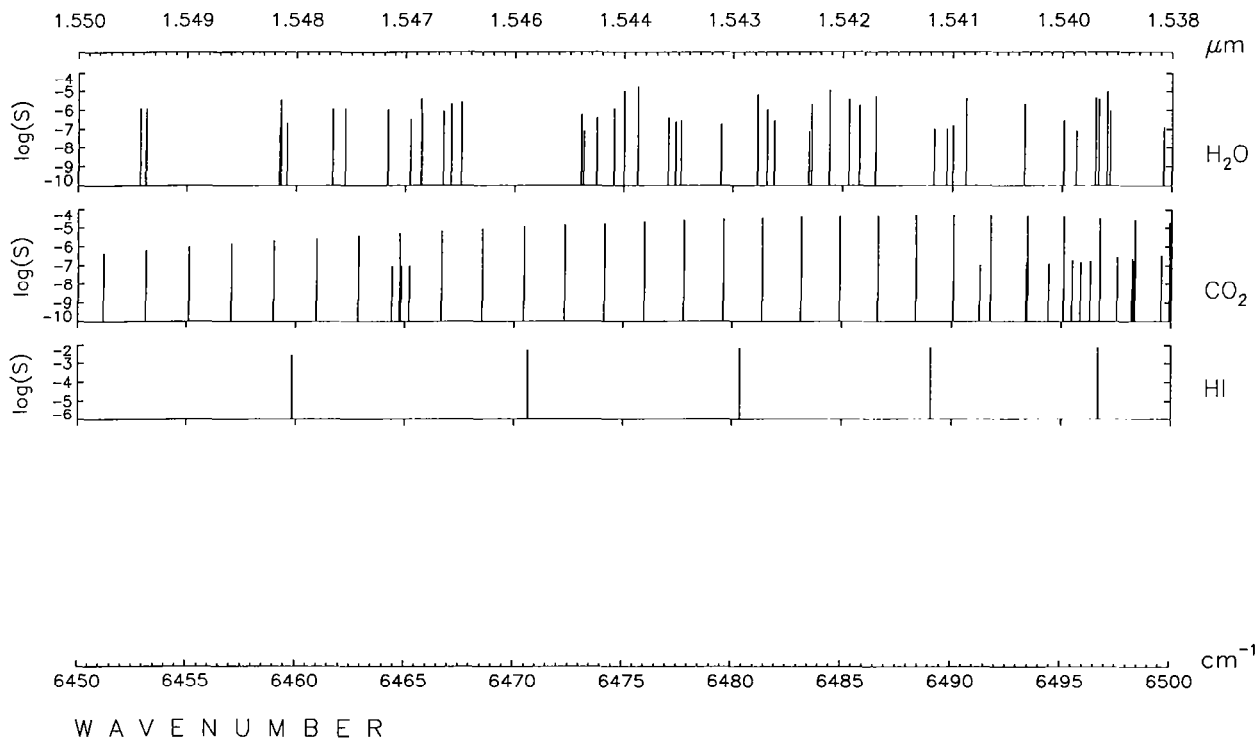
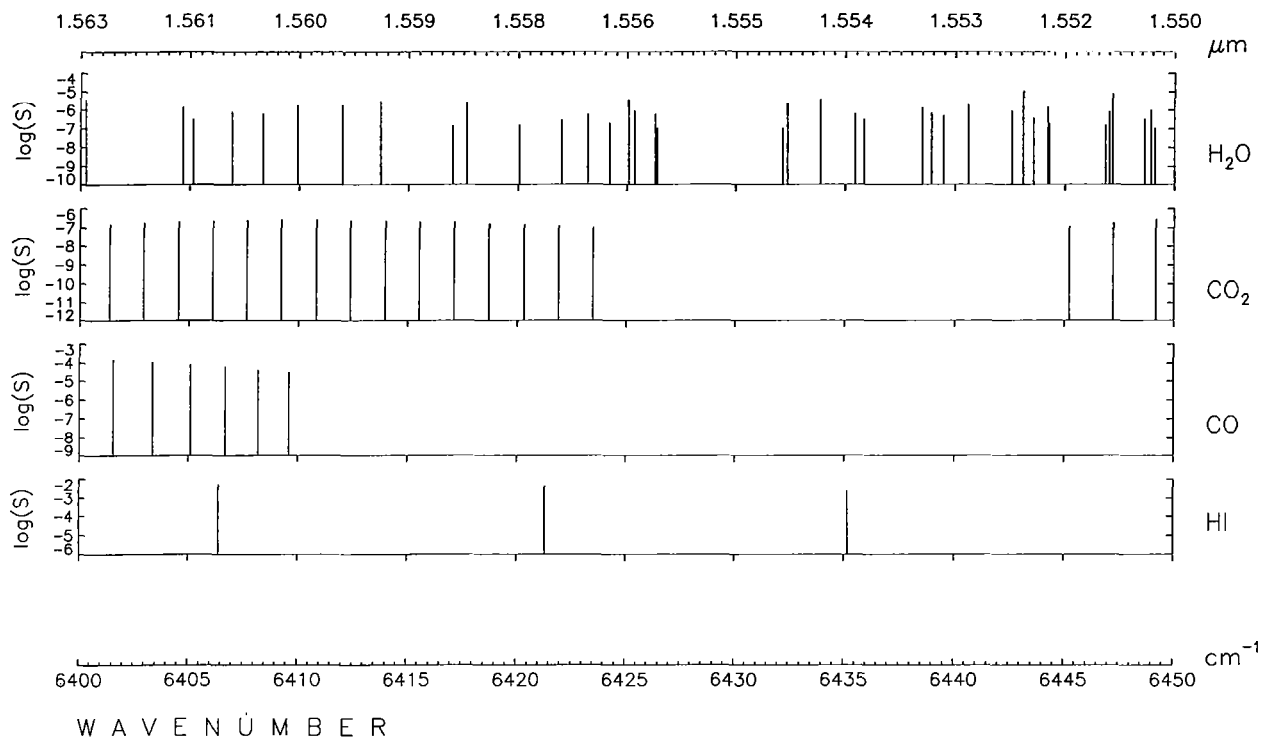


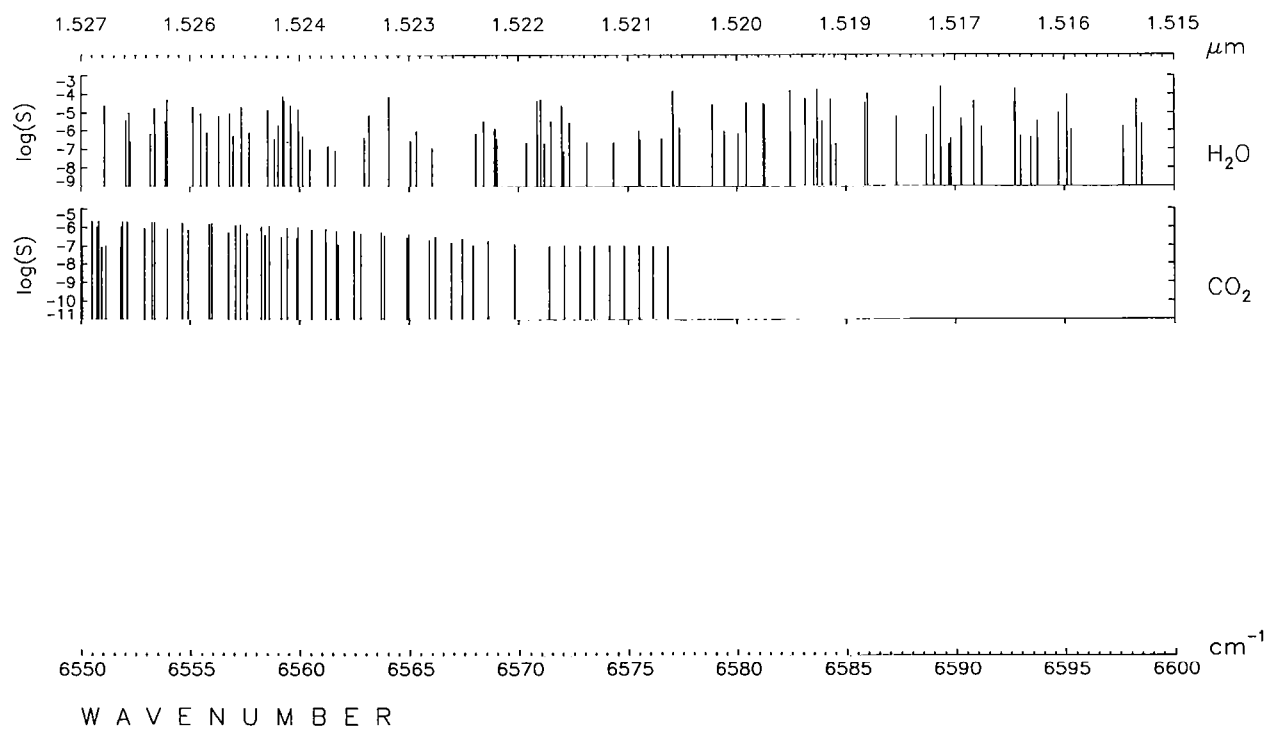
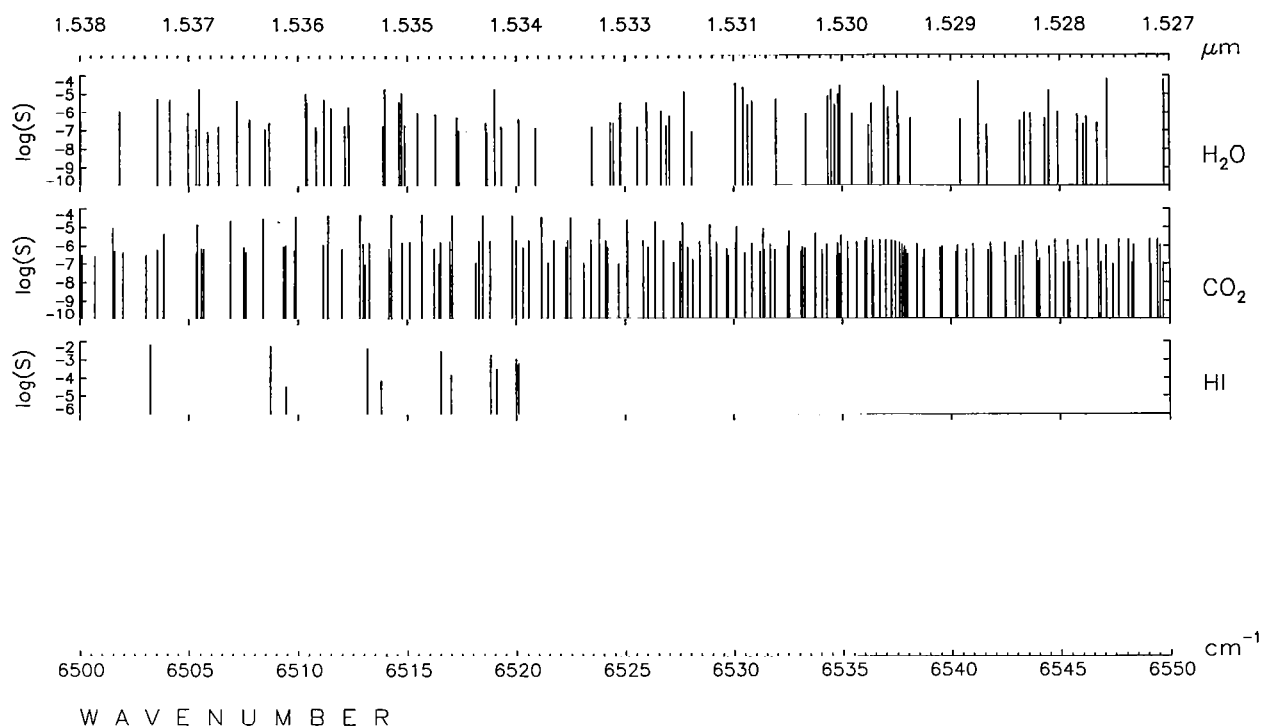


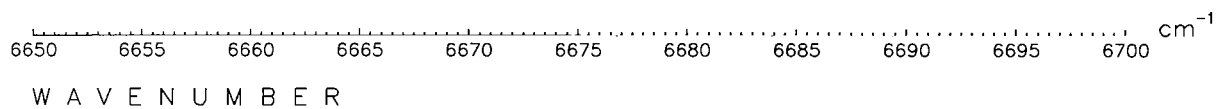
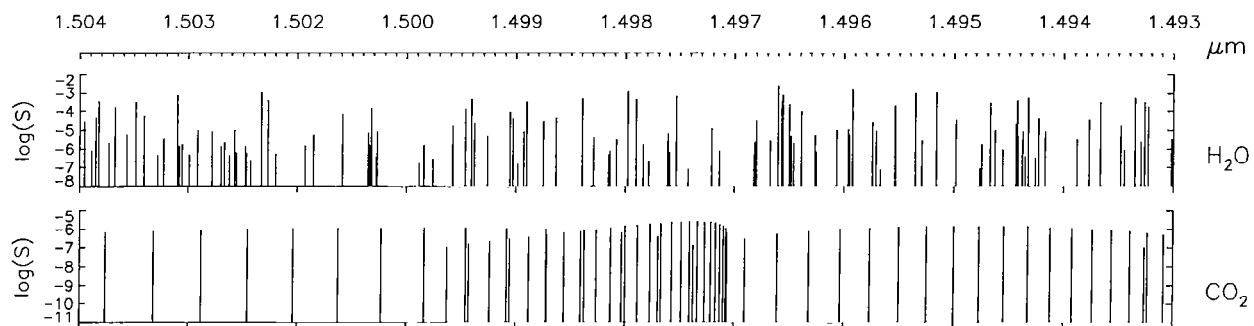
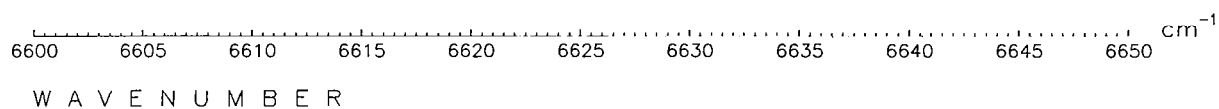
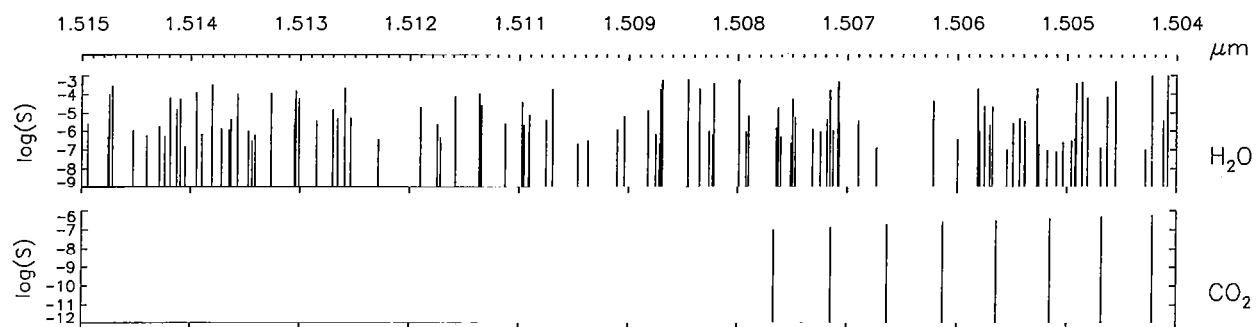


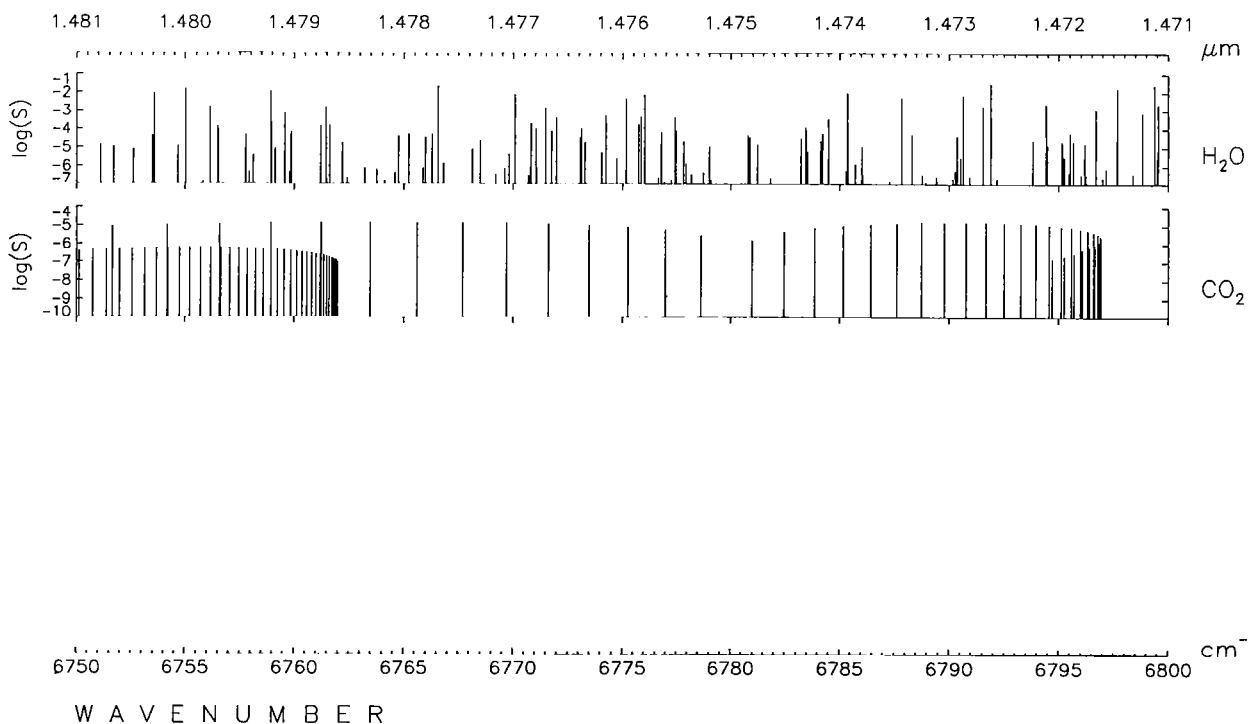
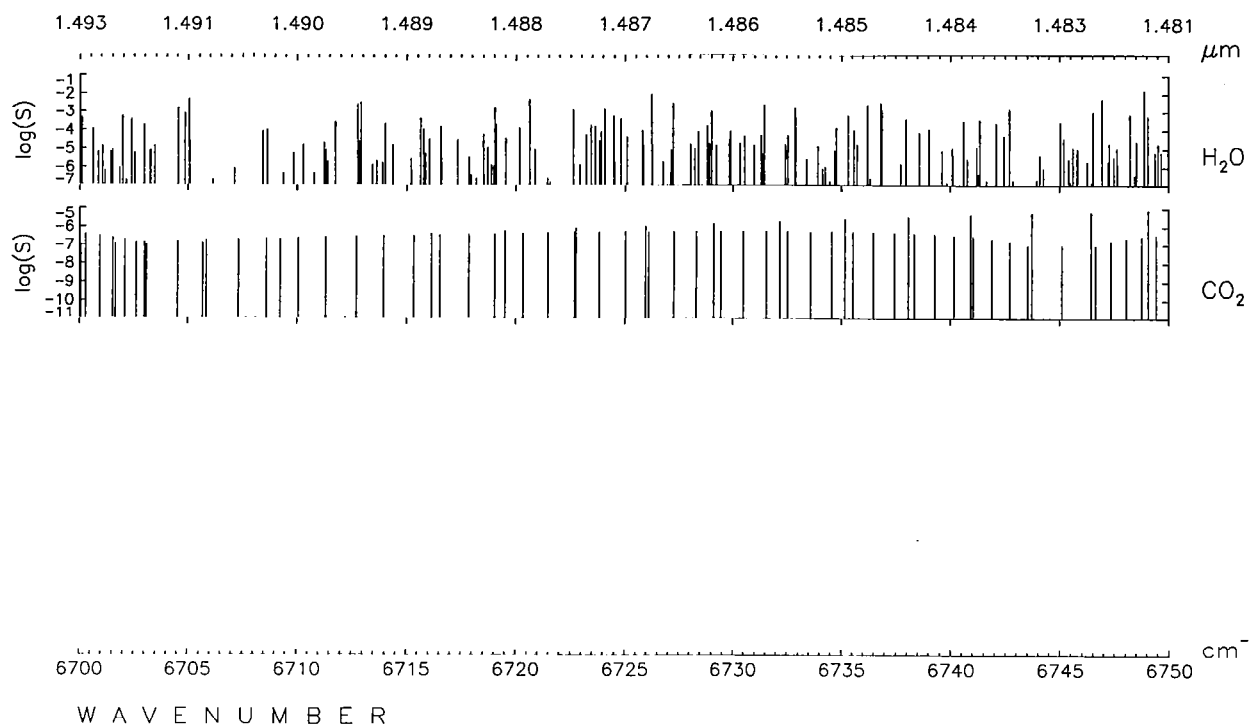




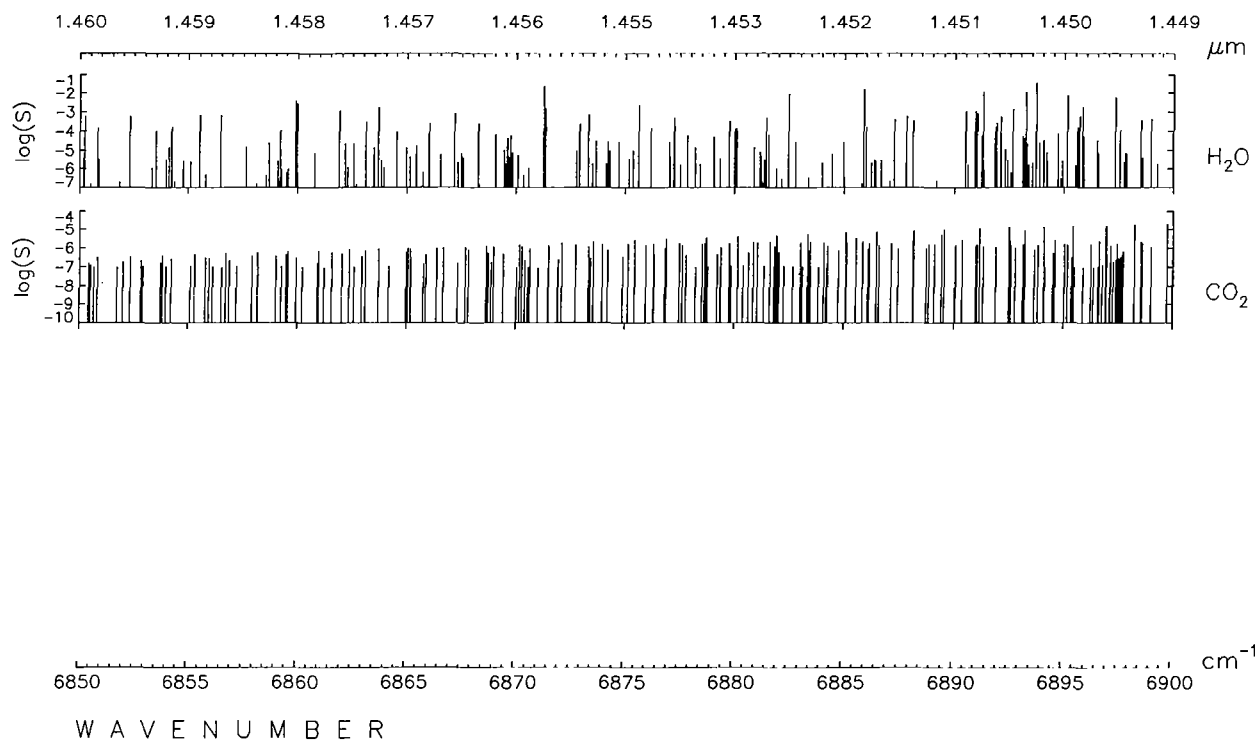
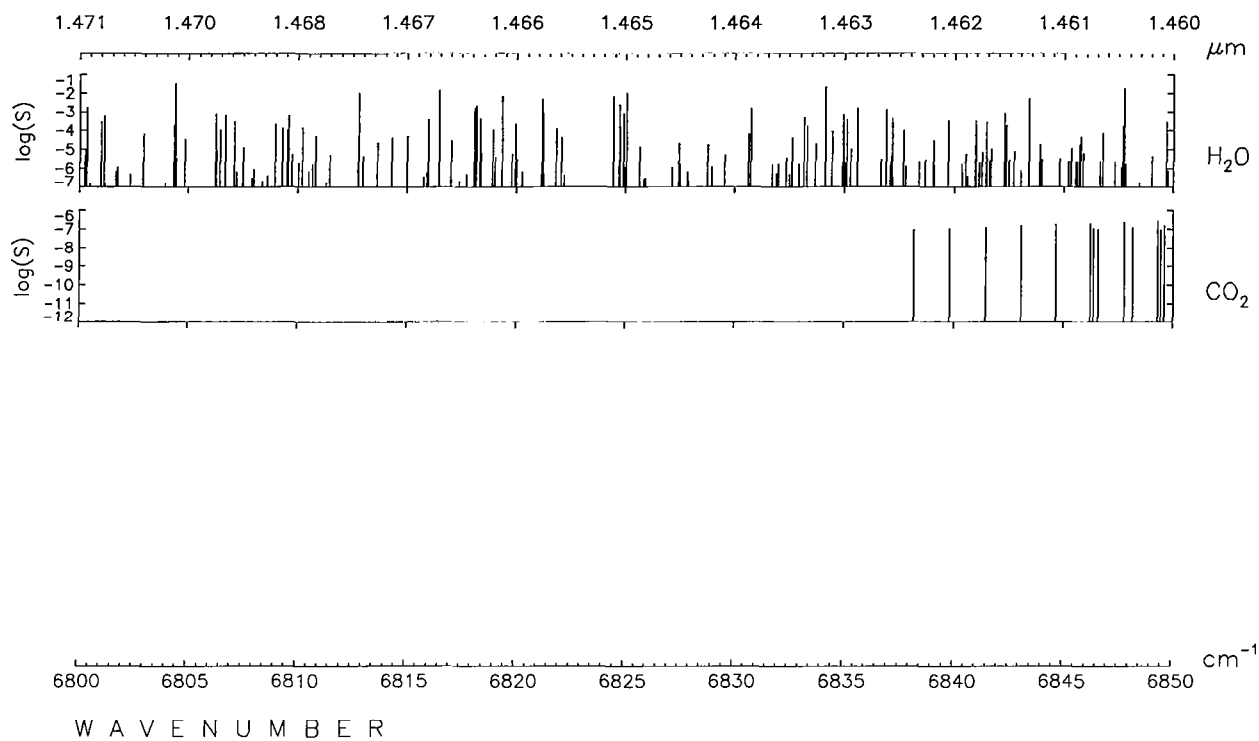


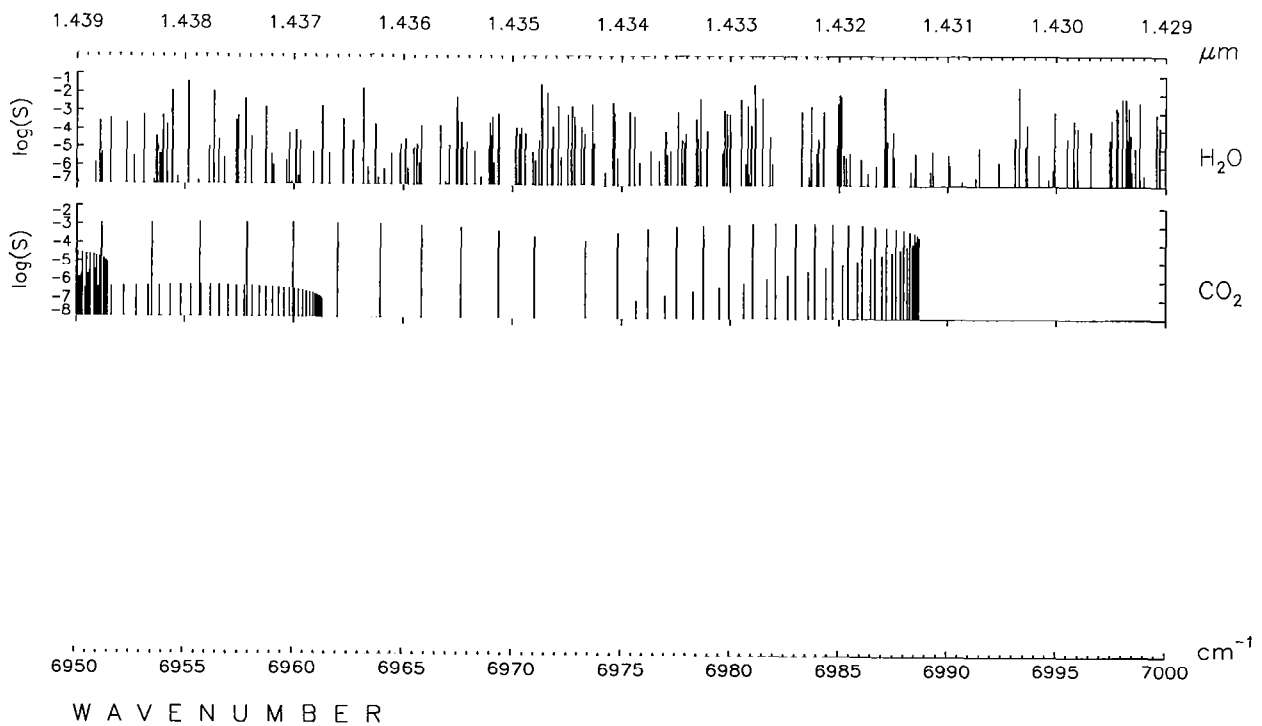
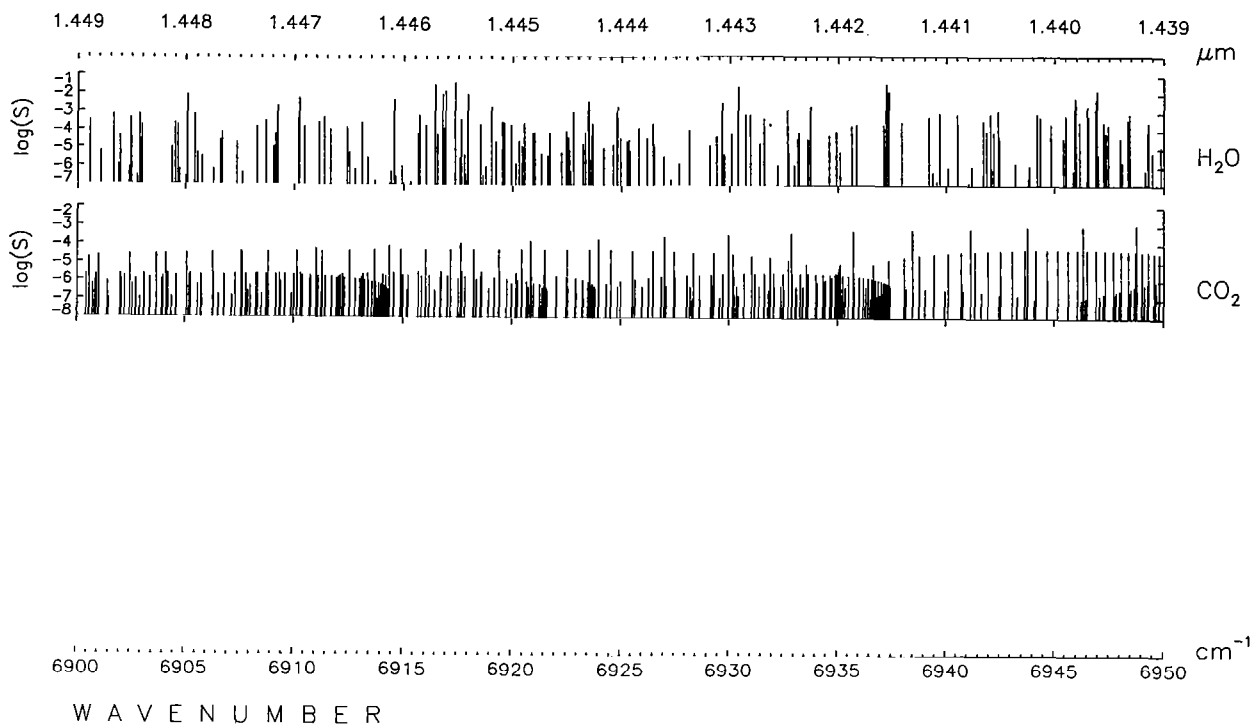


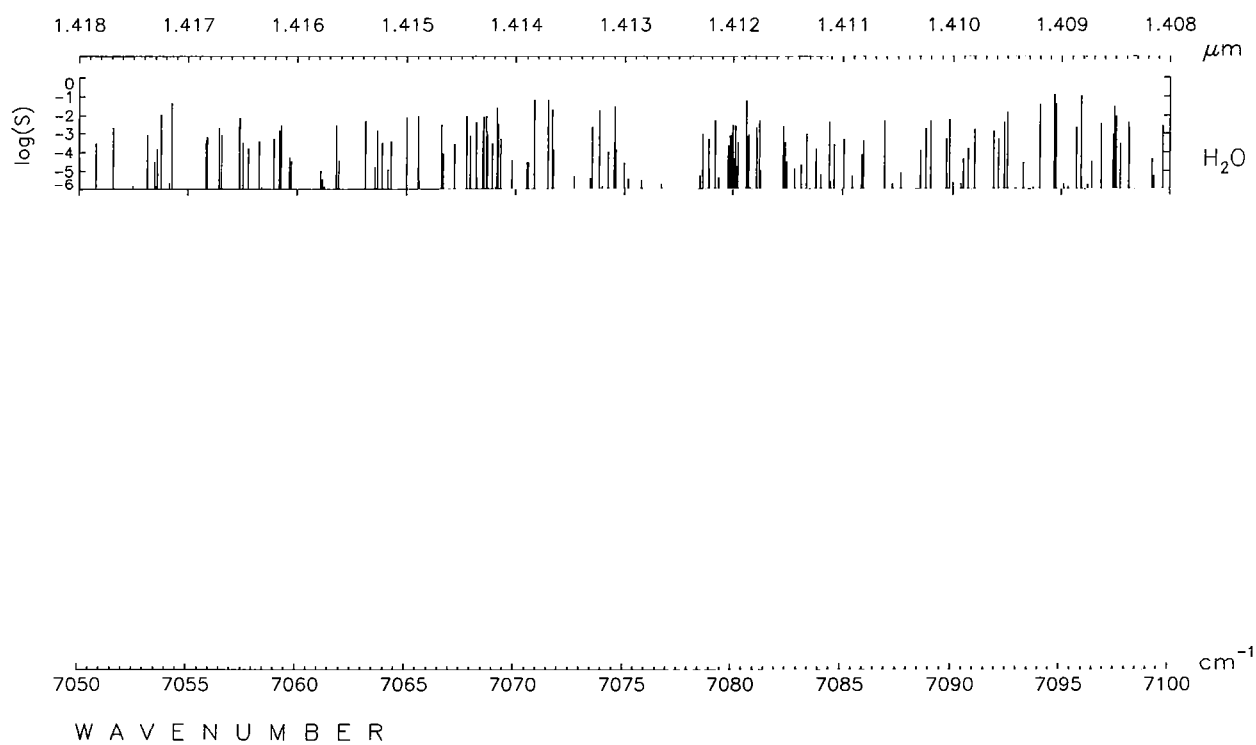
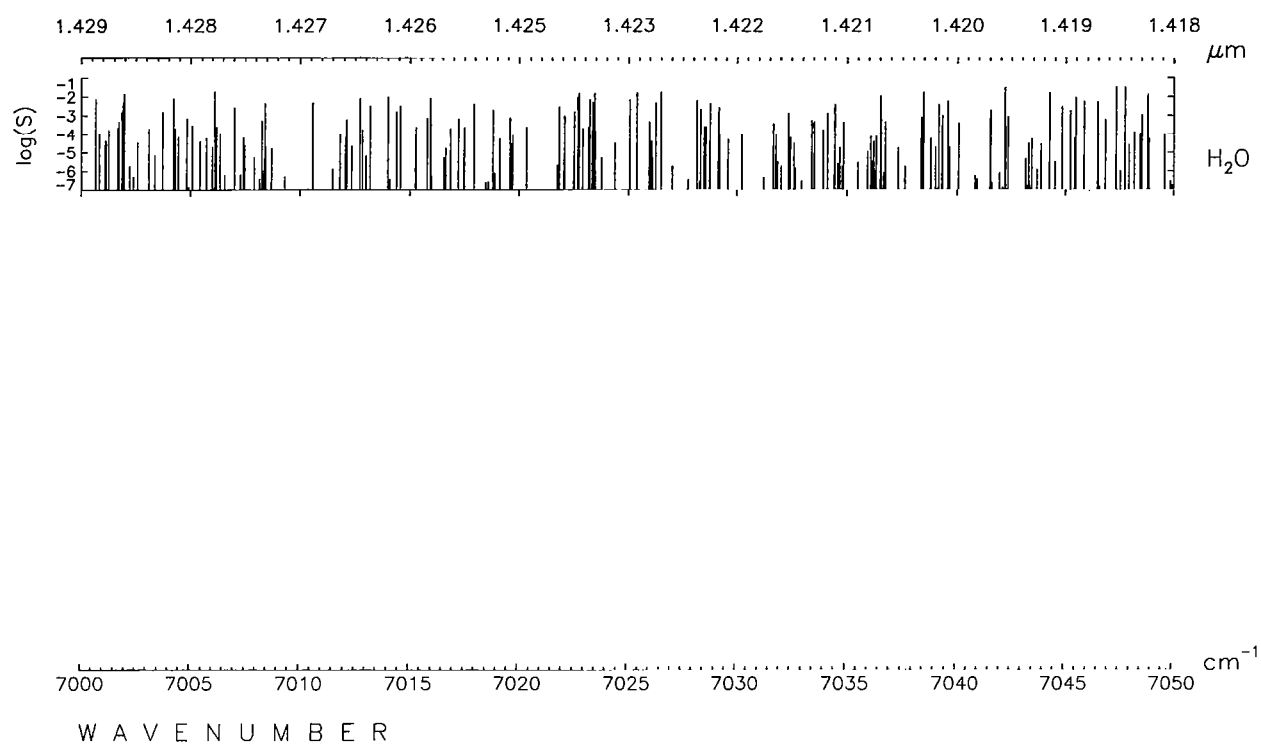


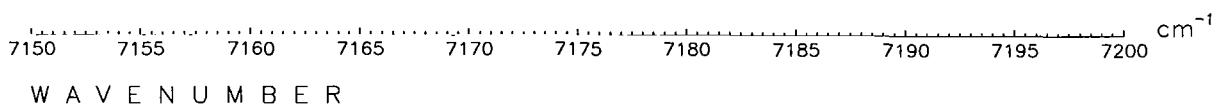
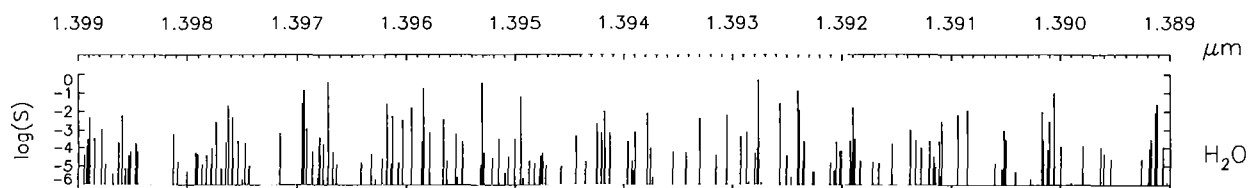
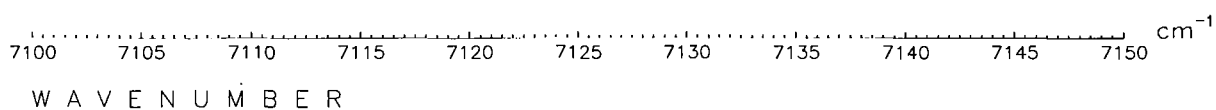
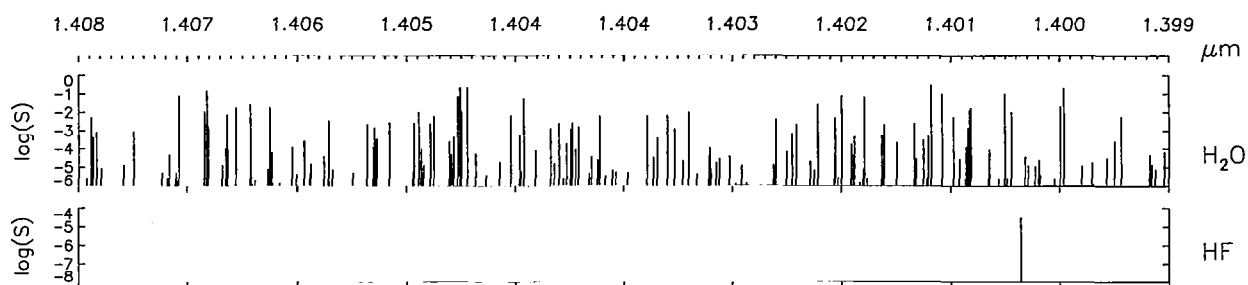


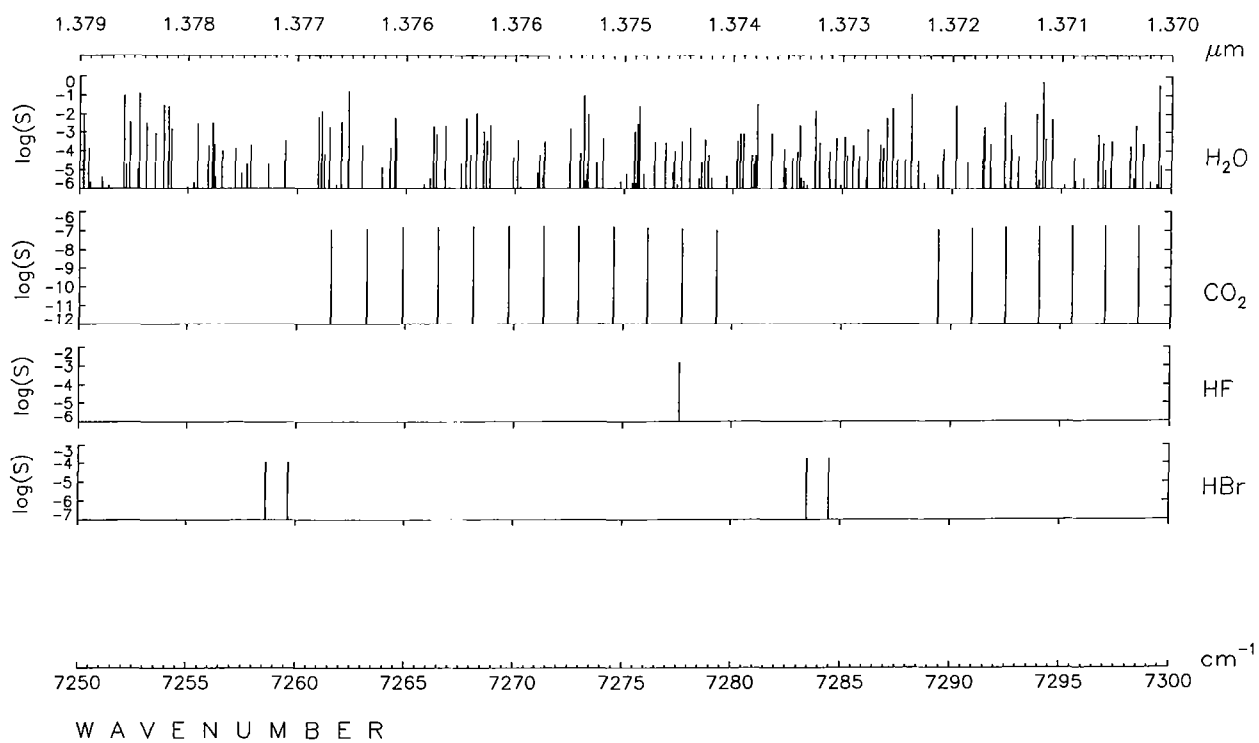
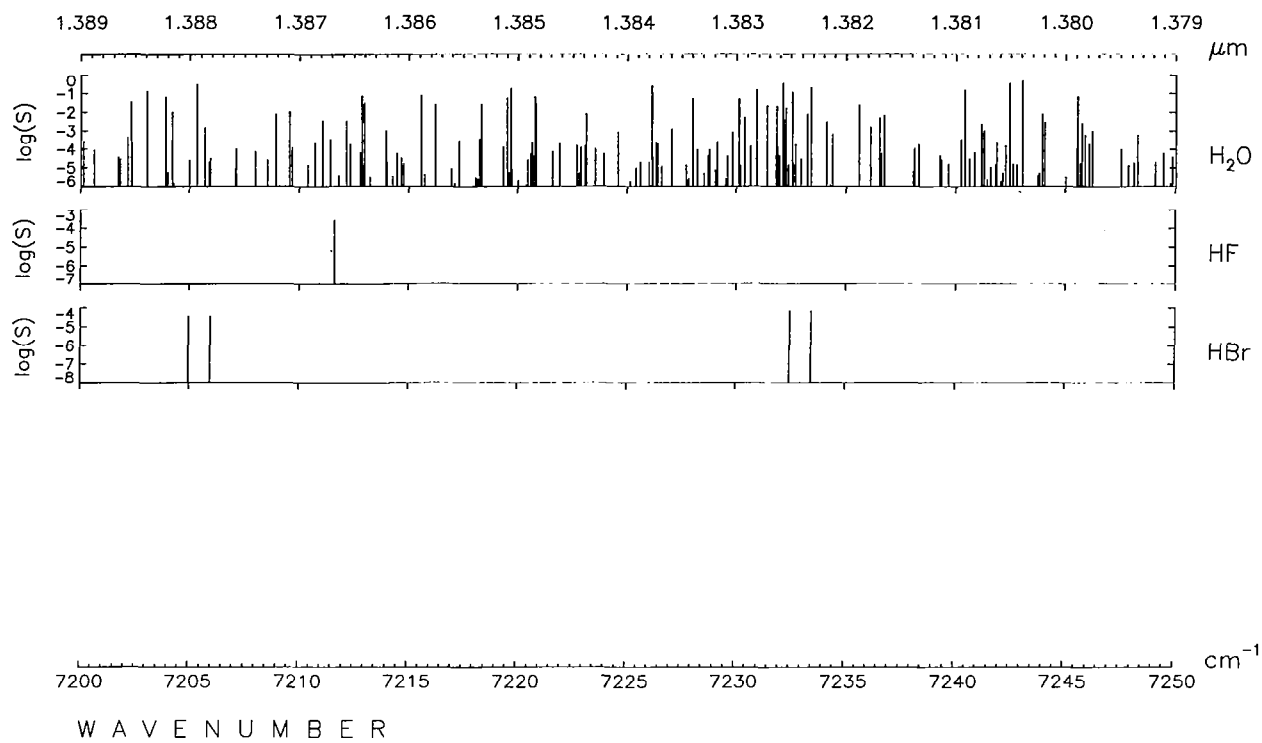


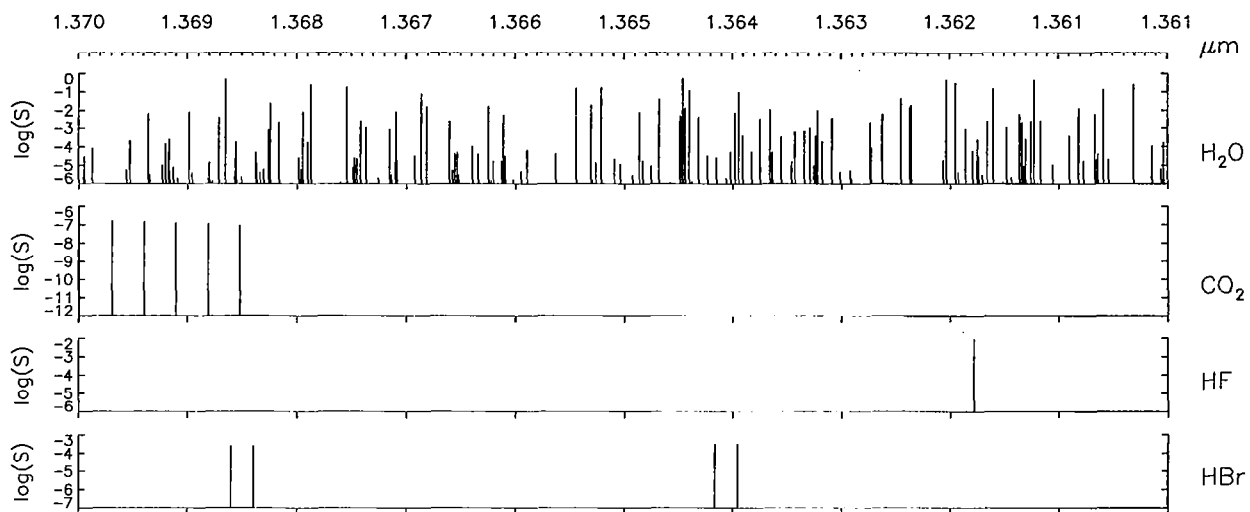




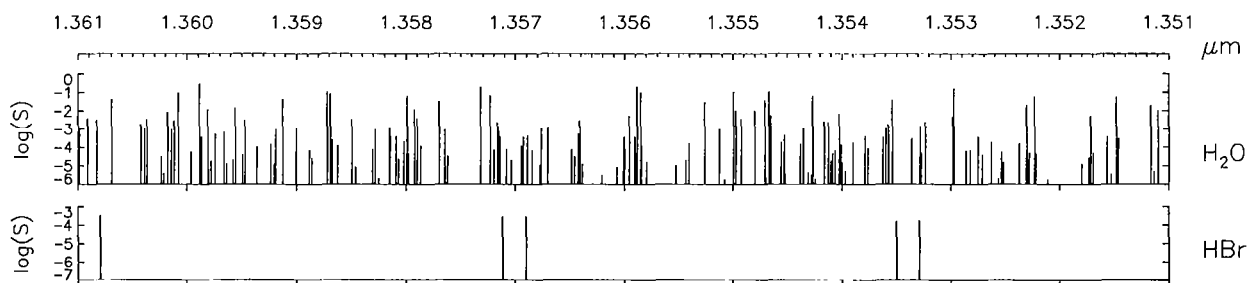




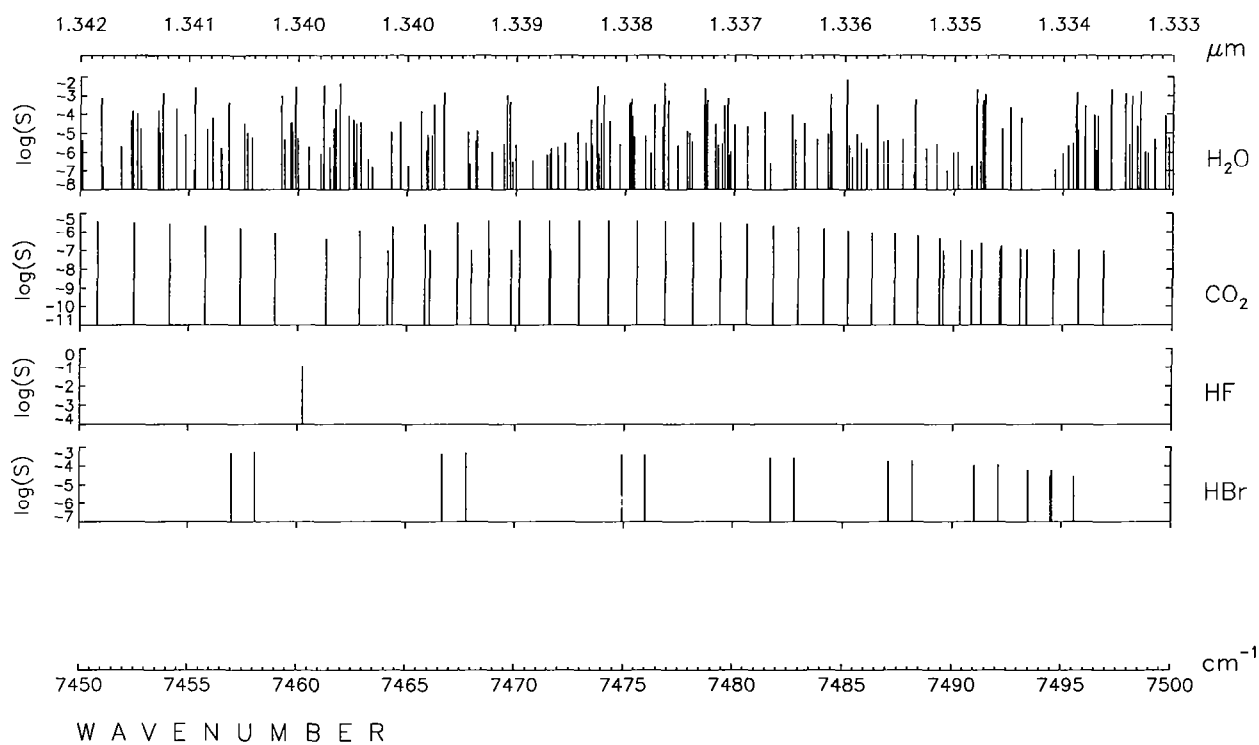
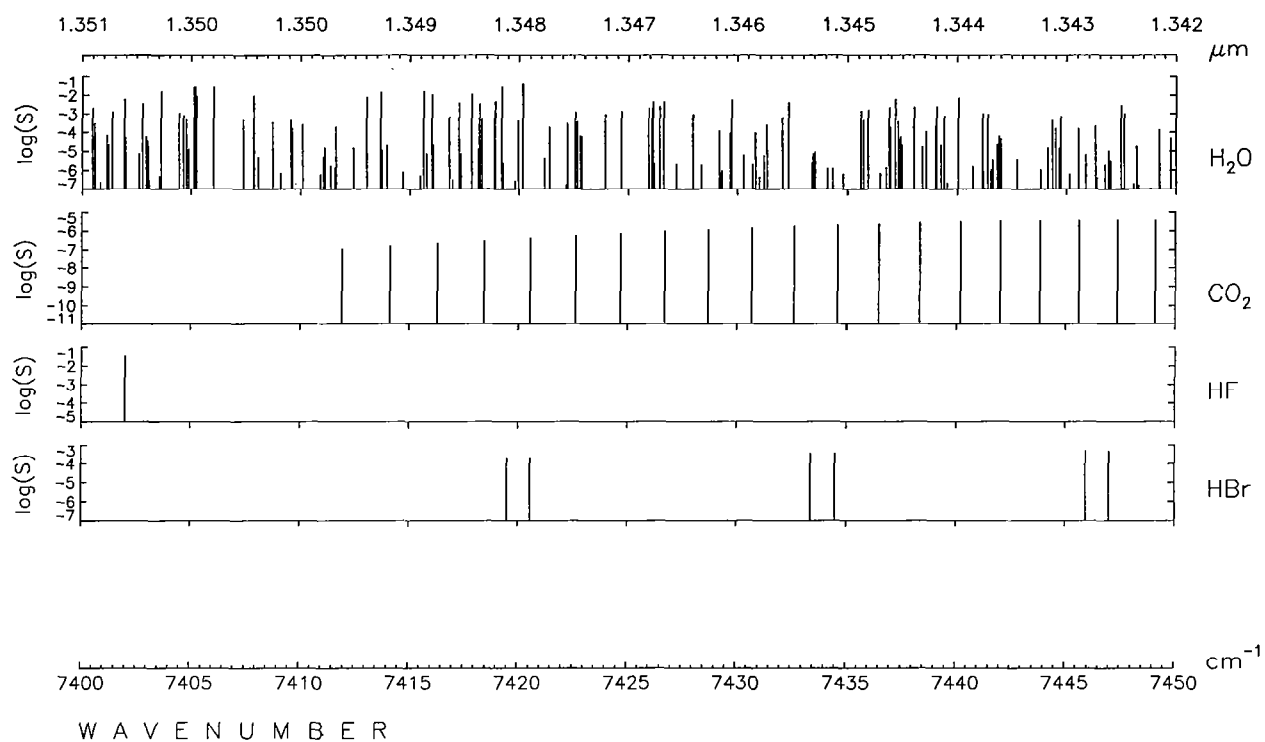


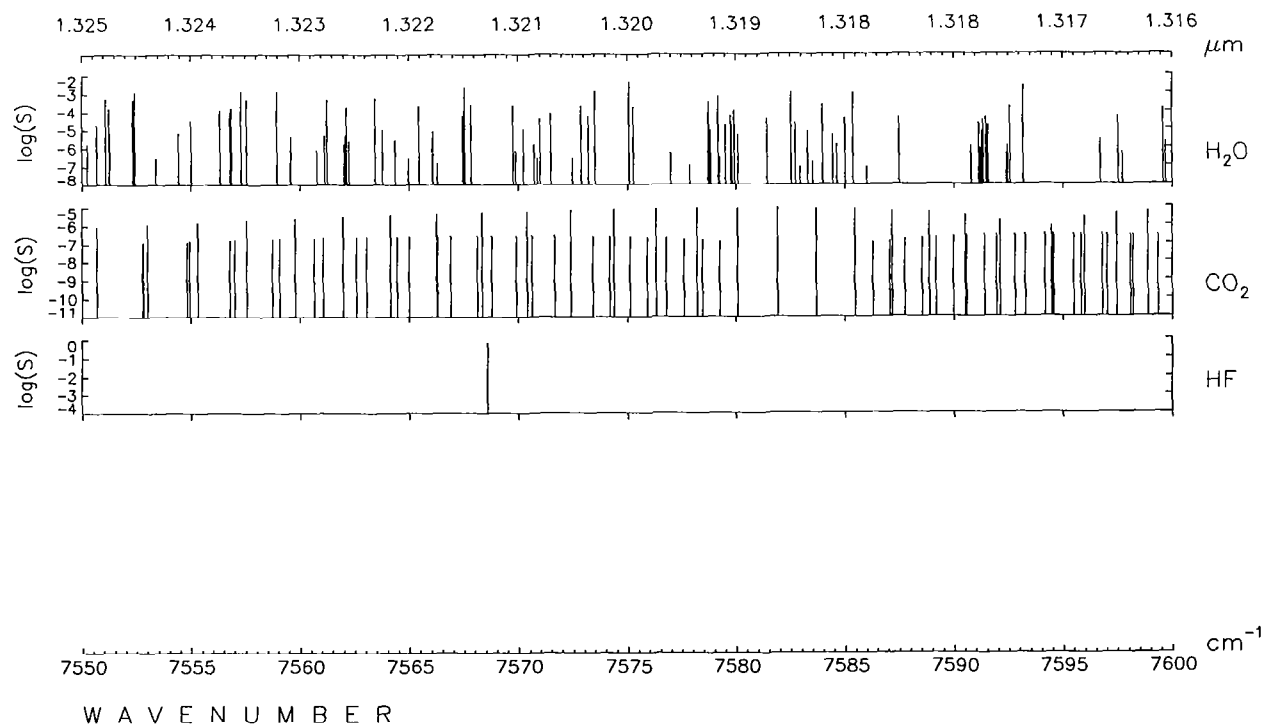
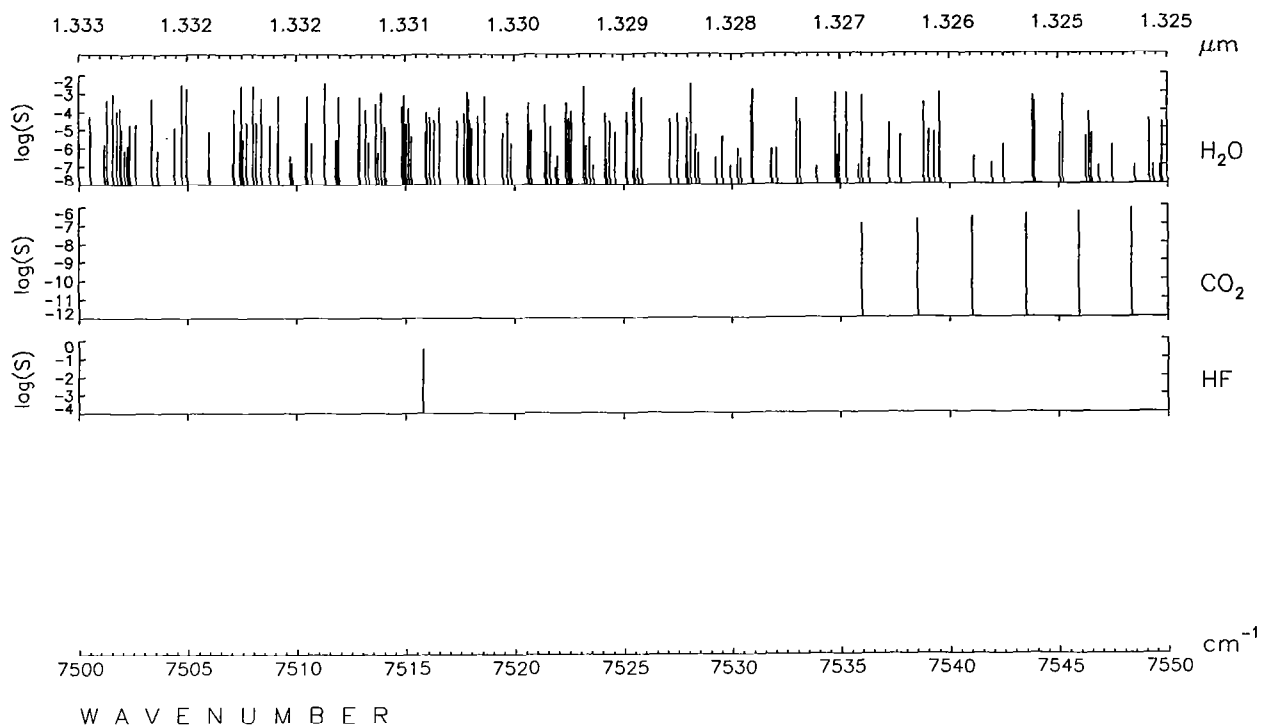


W A V E N U M B E R  $\text{cm}^{-1}$

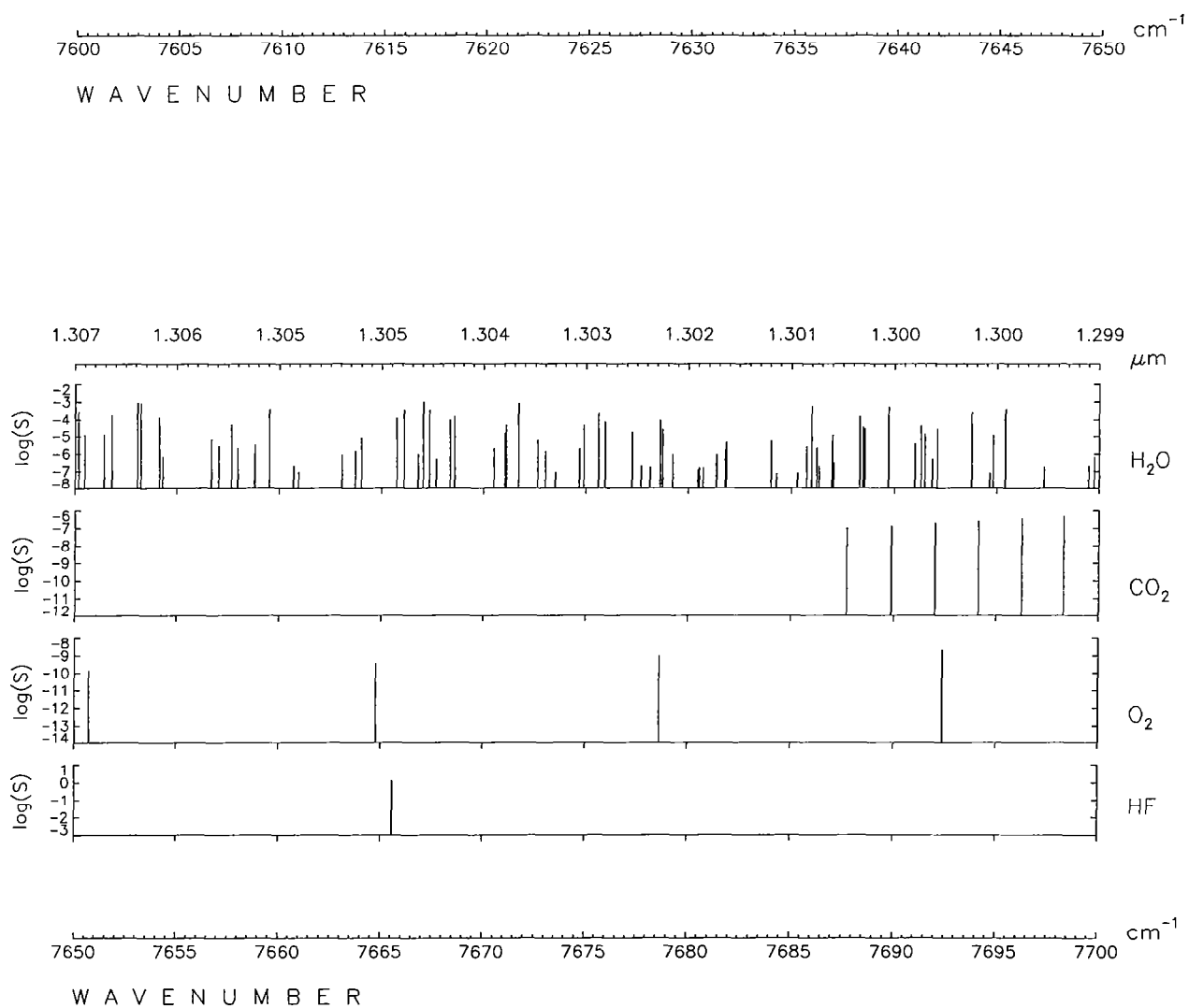
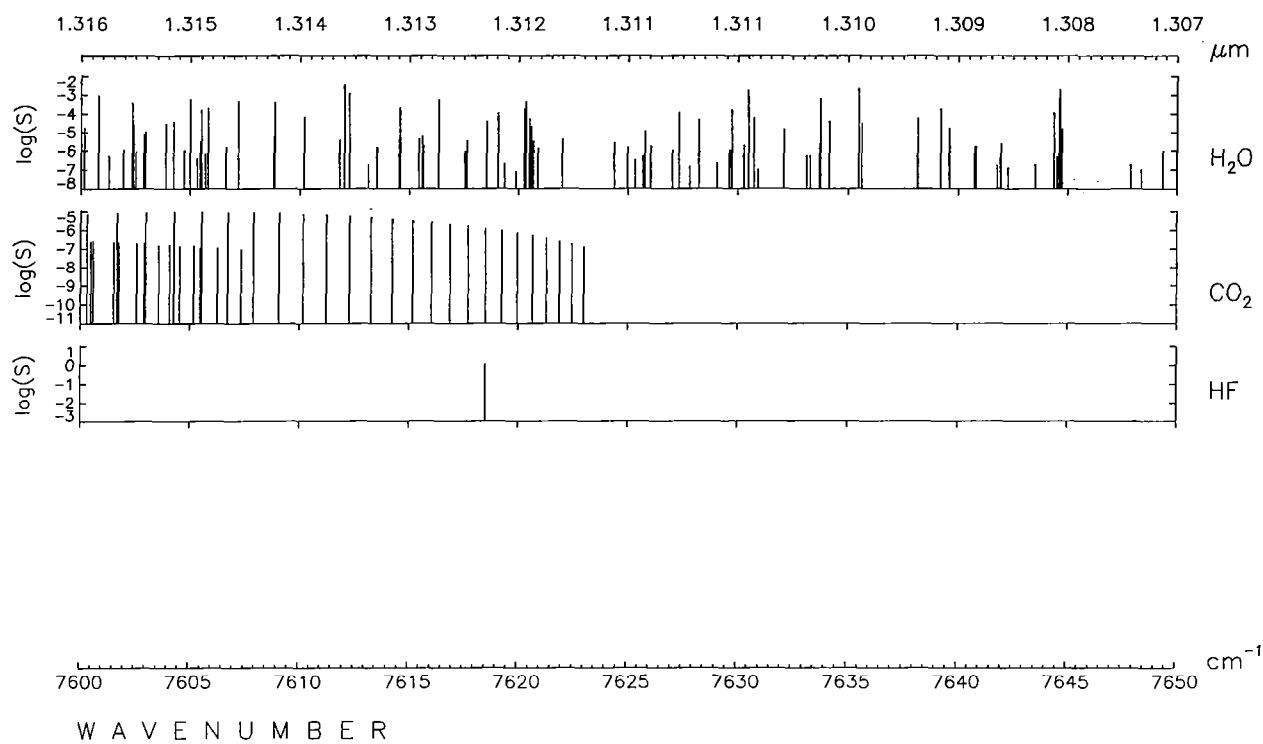


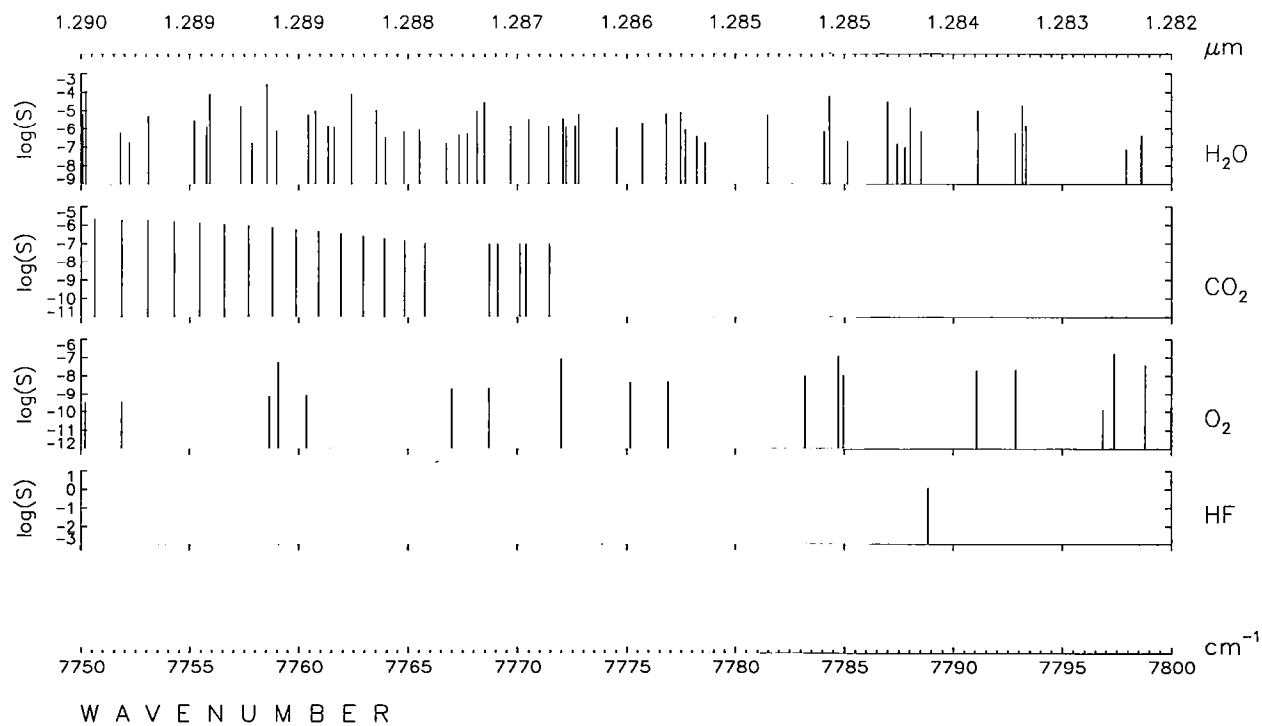
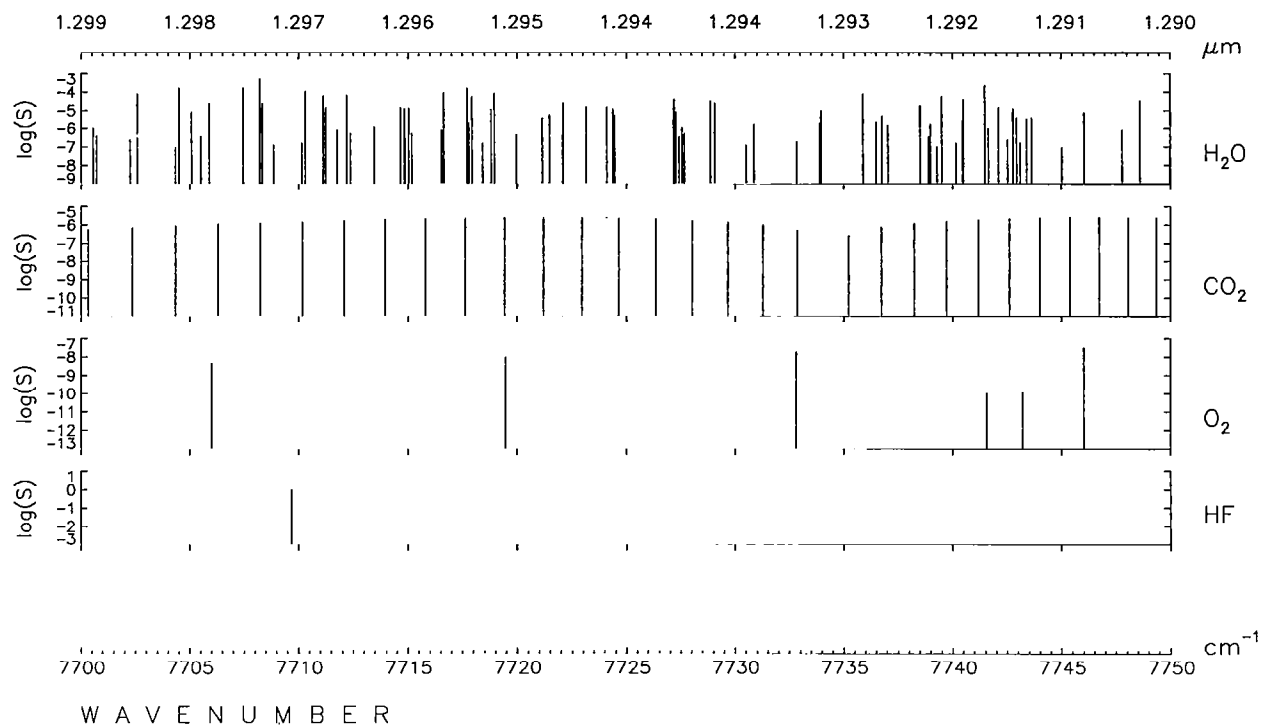
W A V E N U M B E R  $\text{cm}^{-1}$

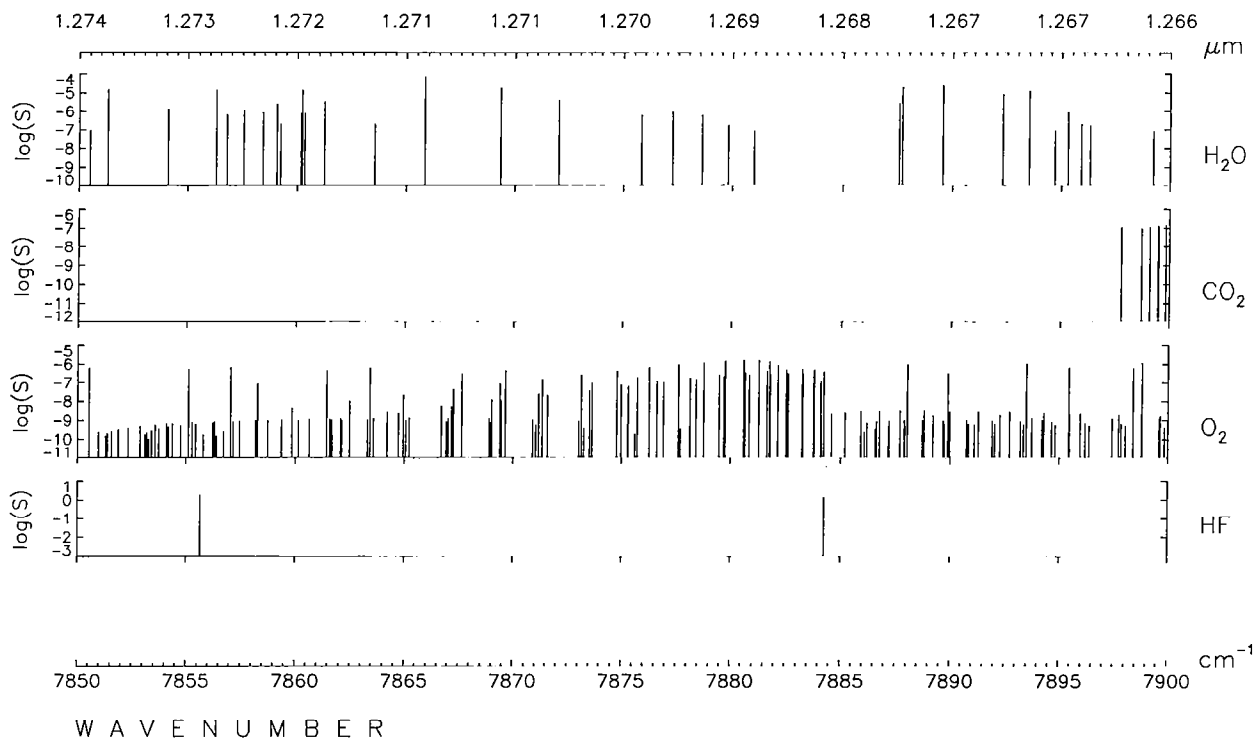
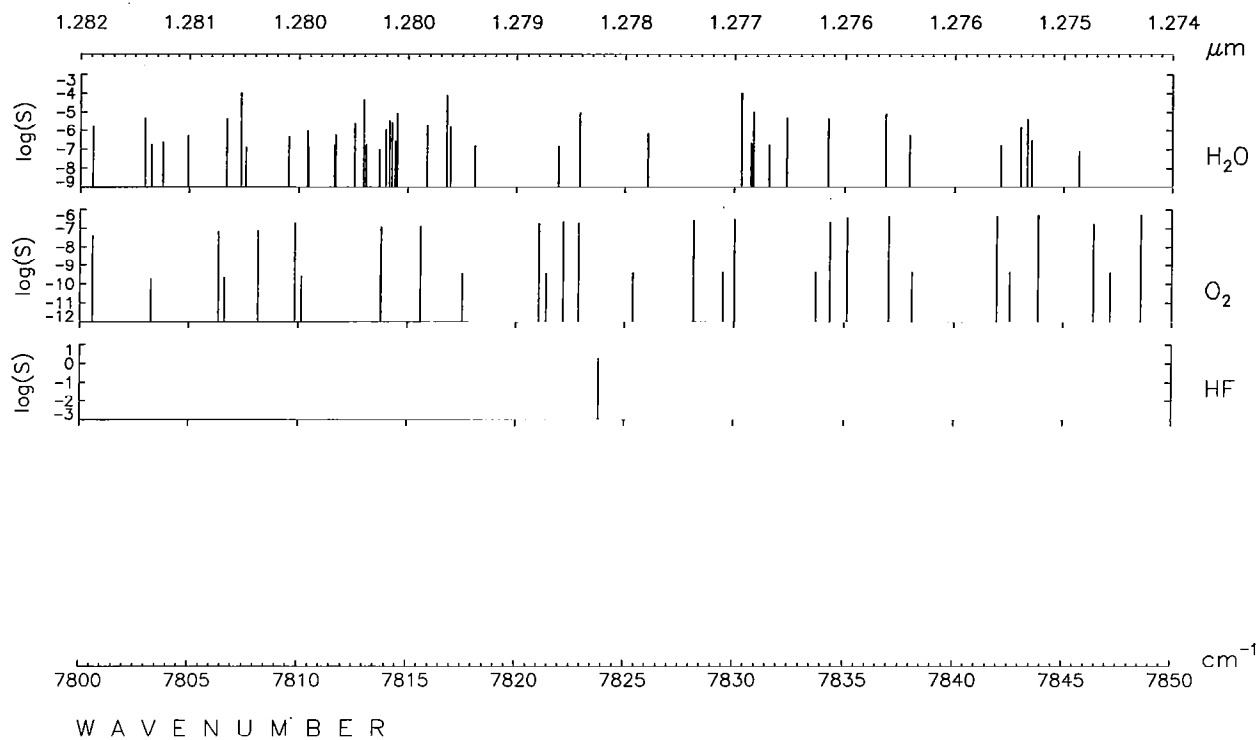


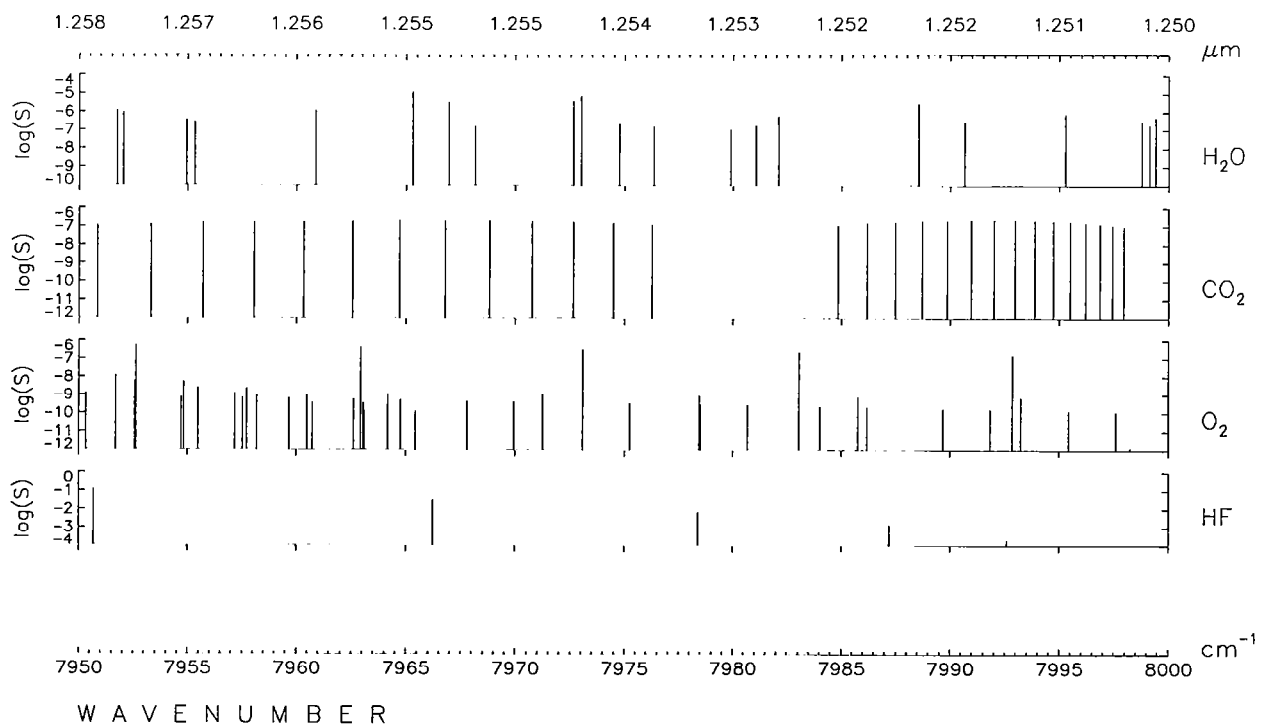
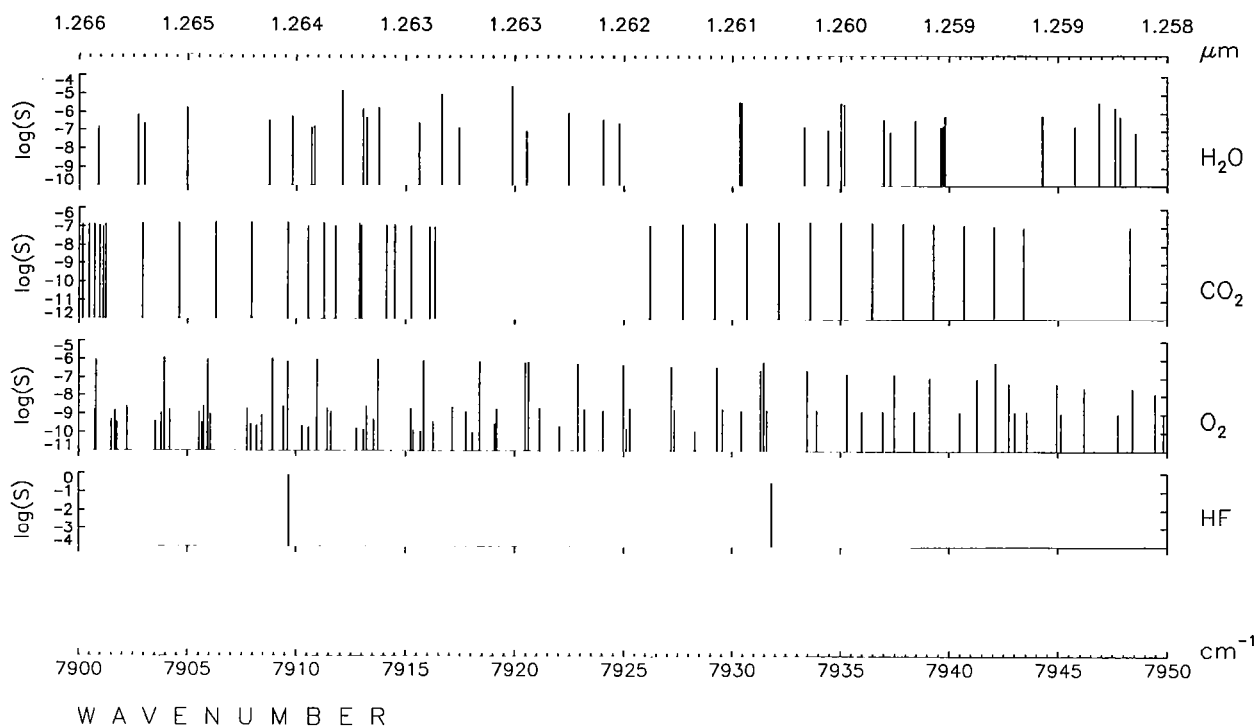


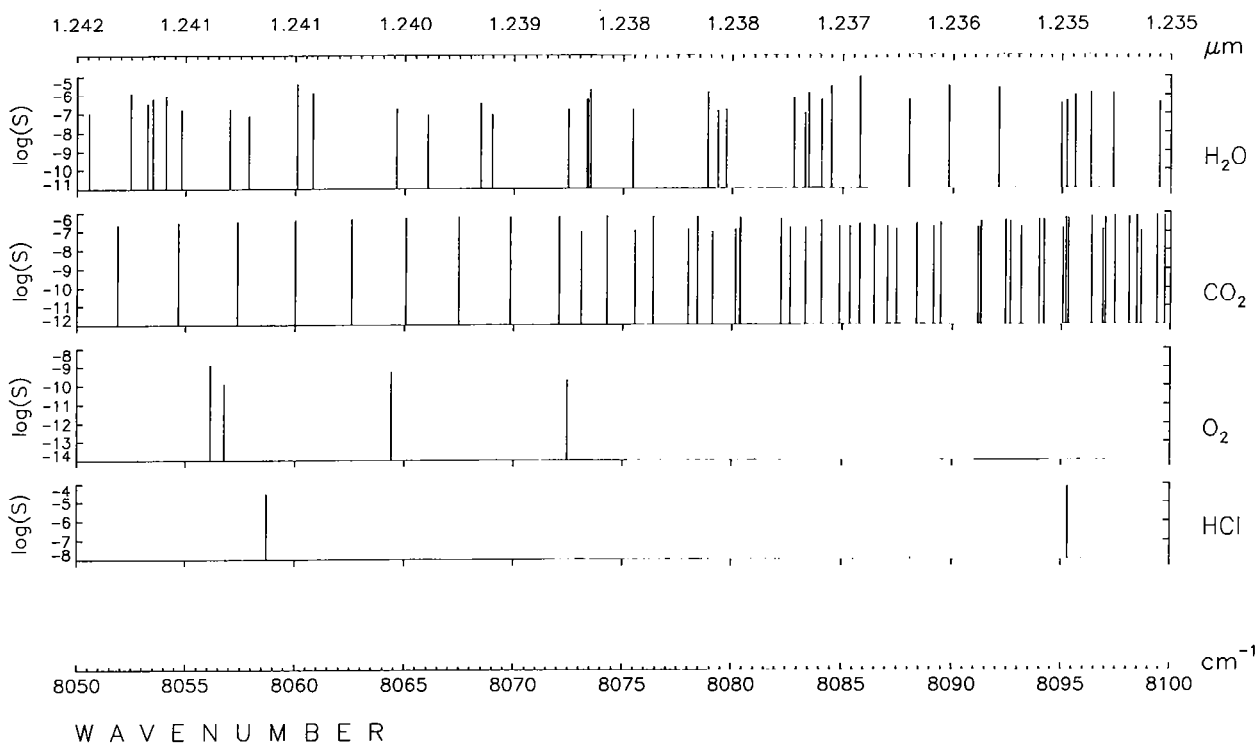
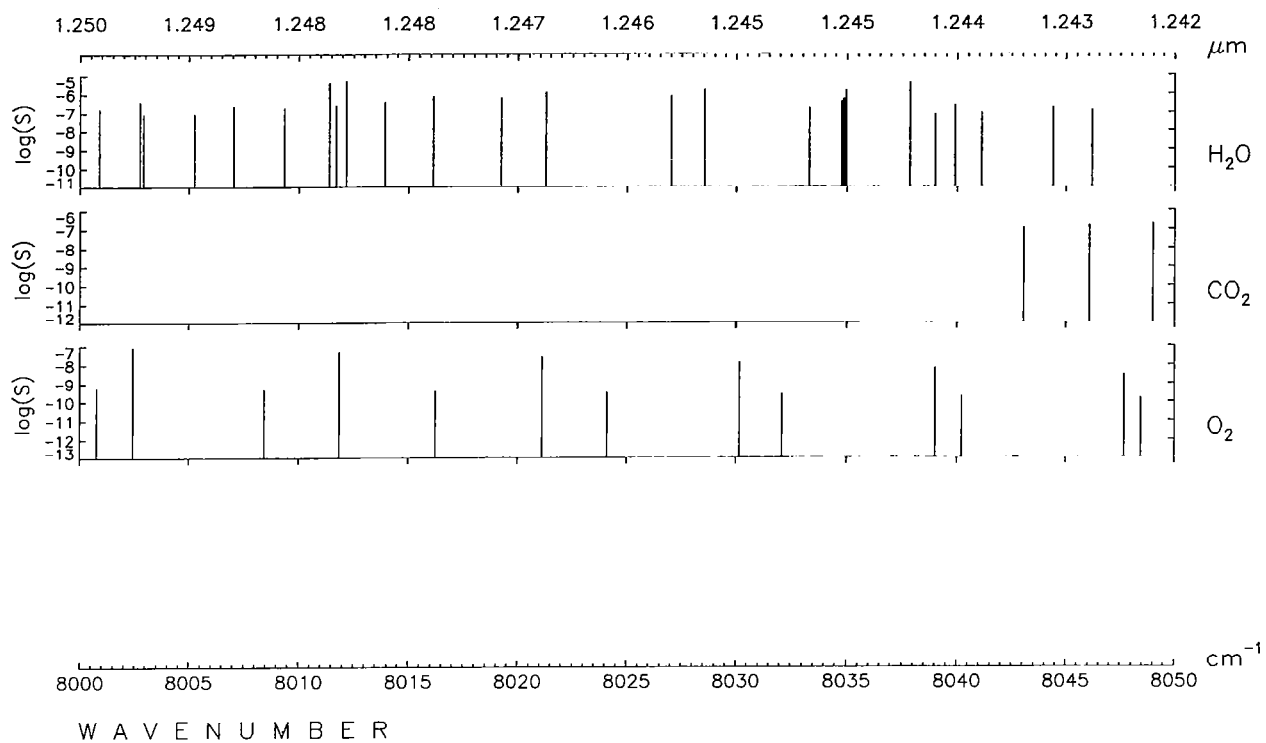


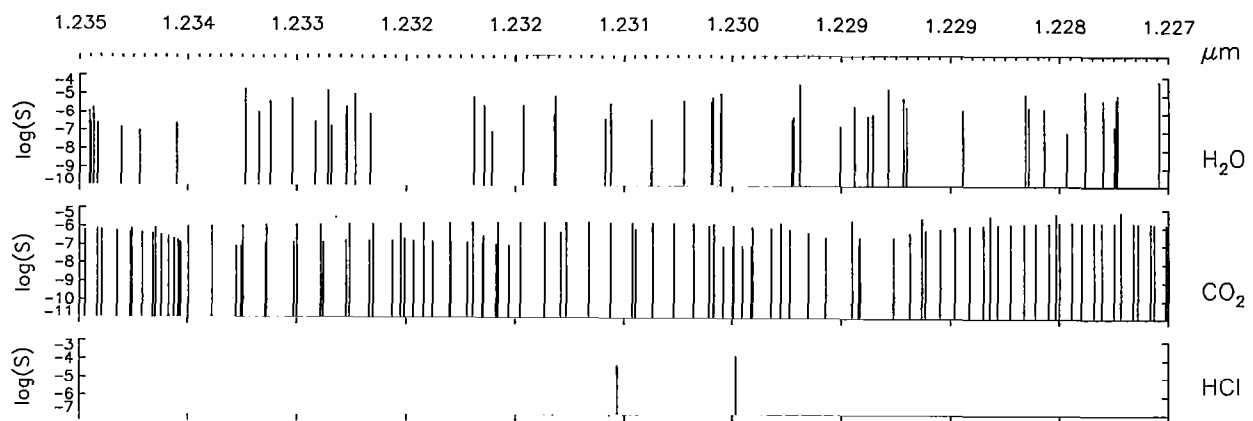




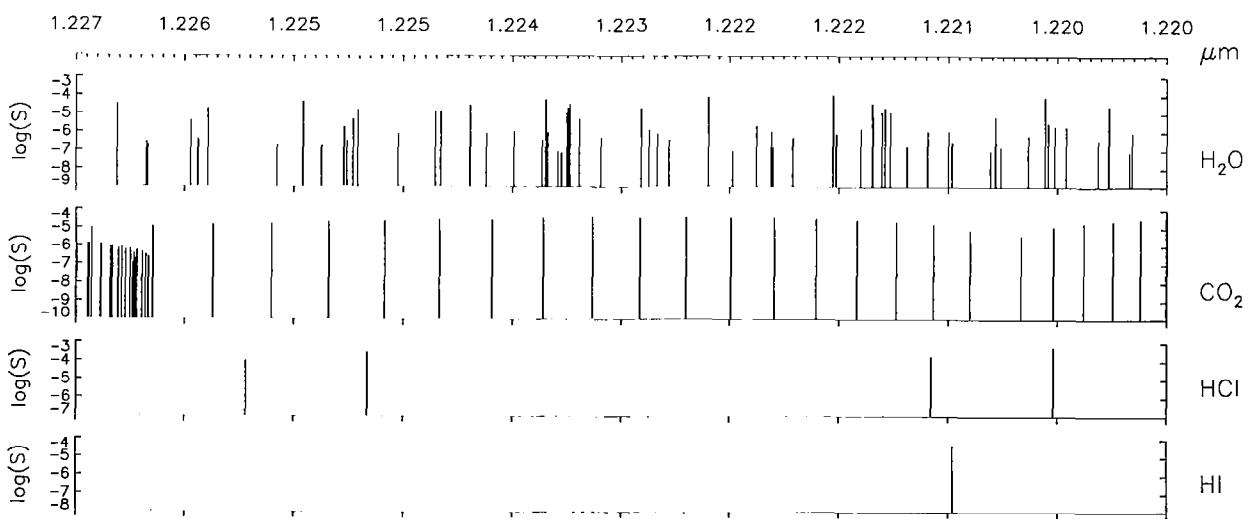




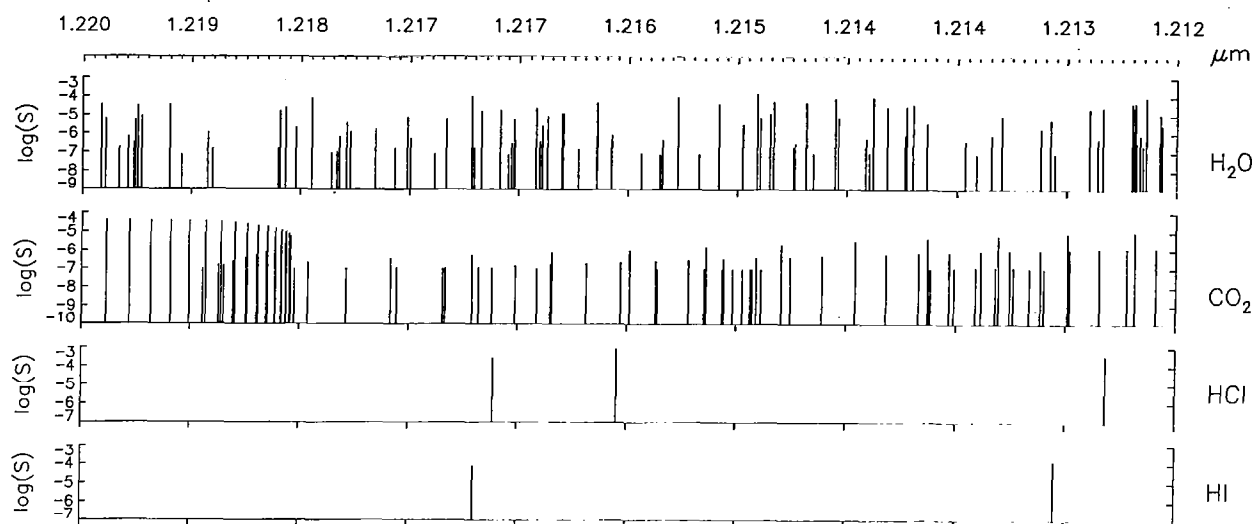




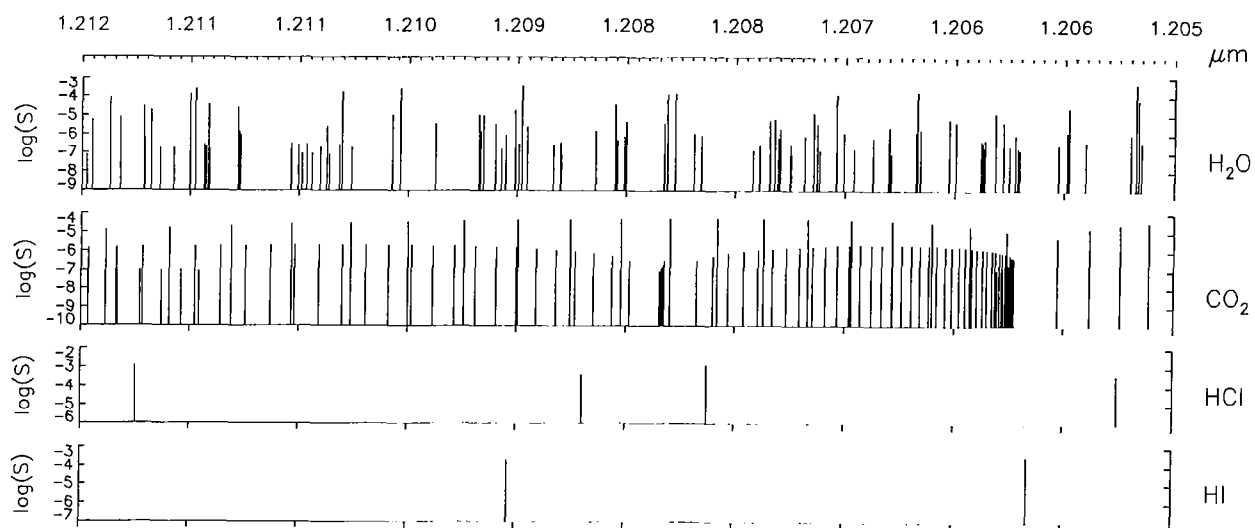
W A V E N U M B E R  $\text{cm}^{-1}$



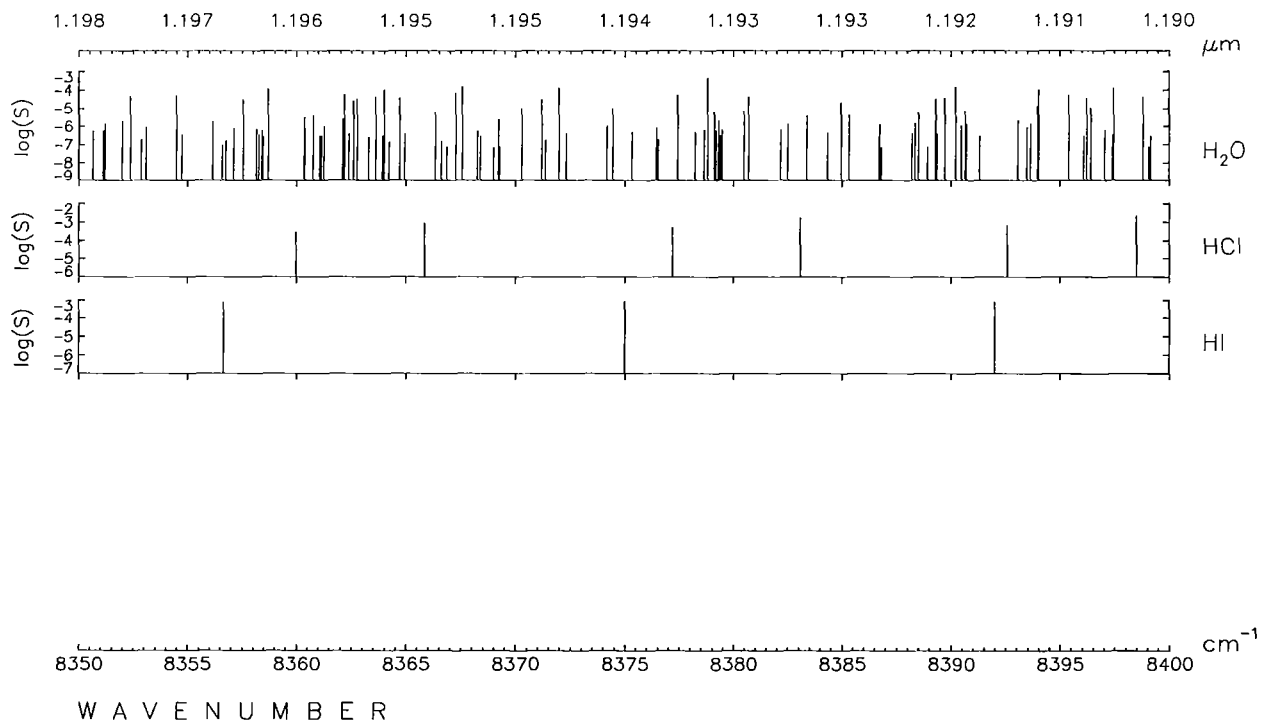
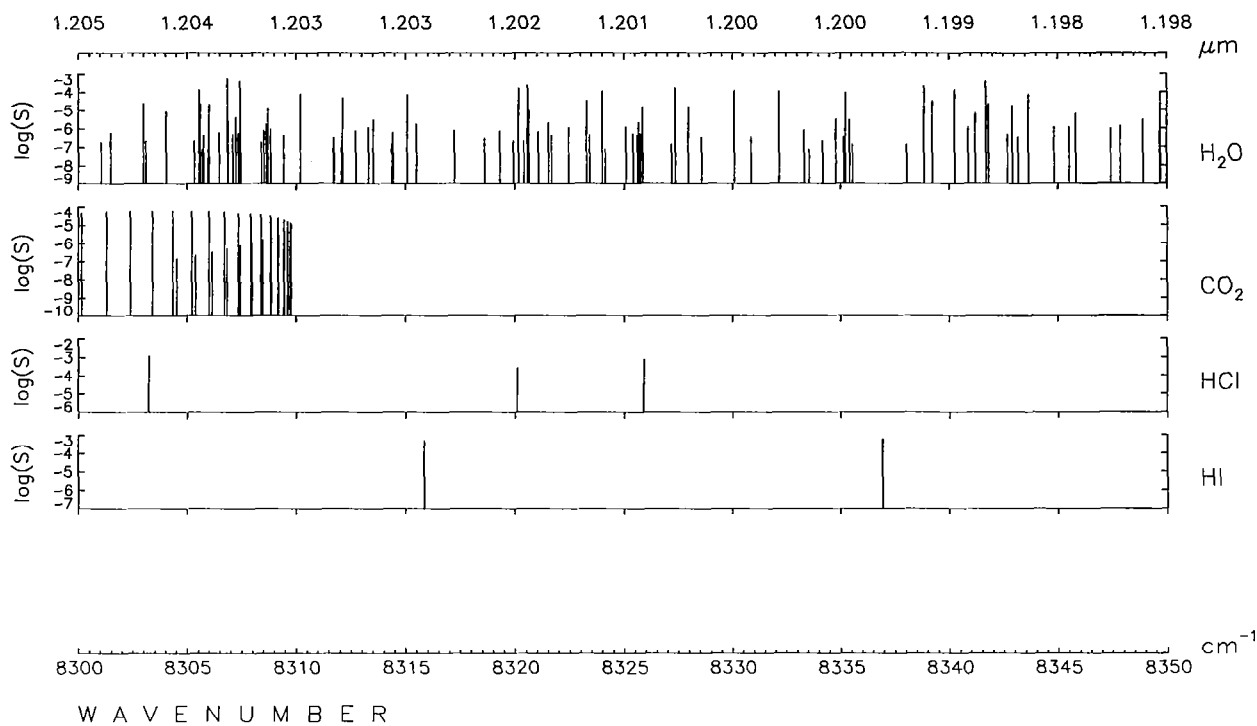
W A V E N U M B E R  $\text{cm}^{-1}$



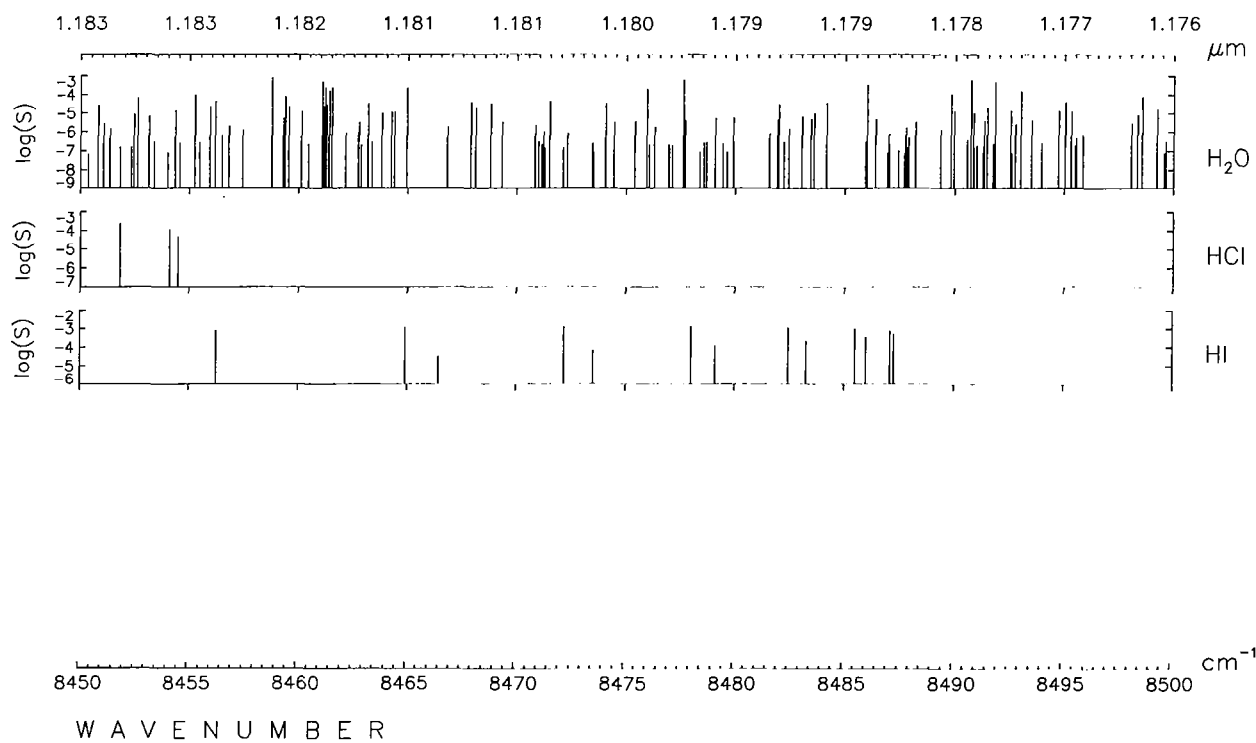
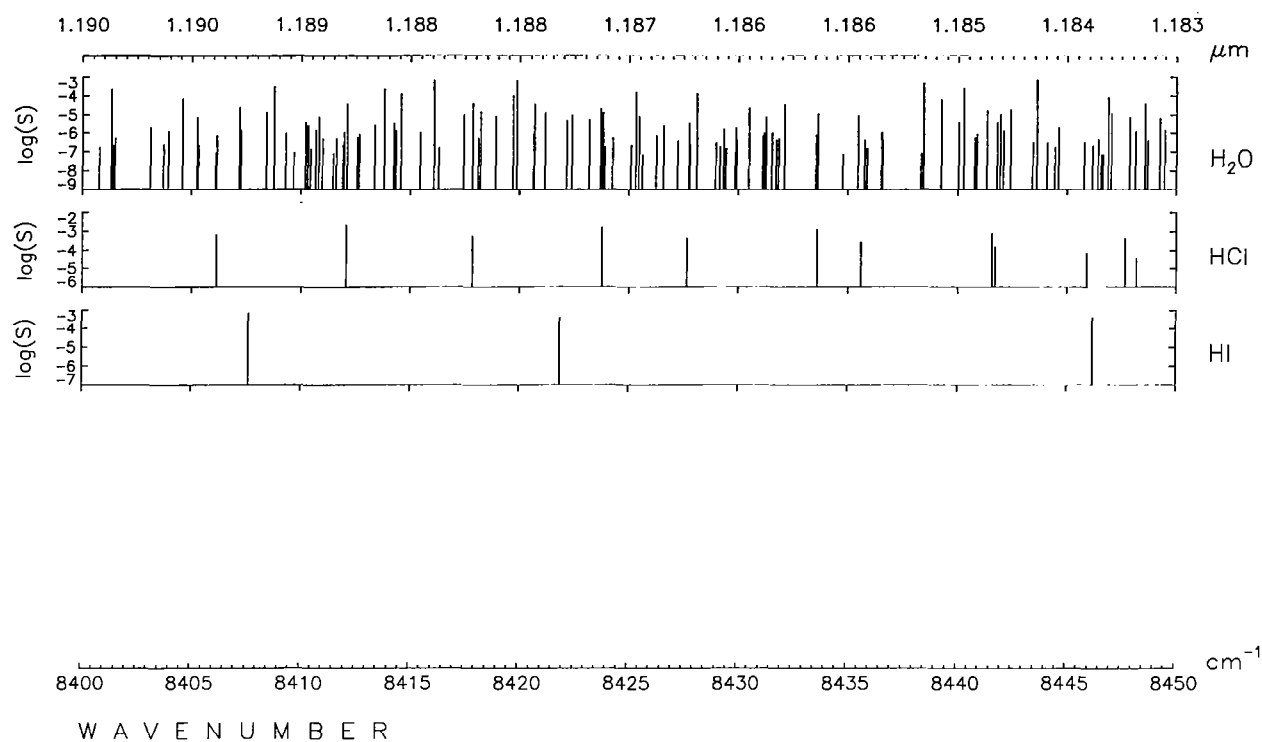
8200 8205 8210 8215 8220 8225 8230 8235 8240 8245 8250  $\text{cm}^{-1}$   
W A V E N U M B E R

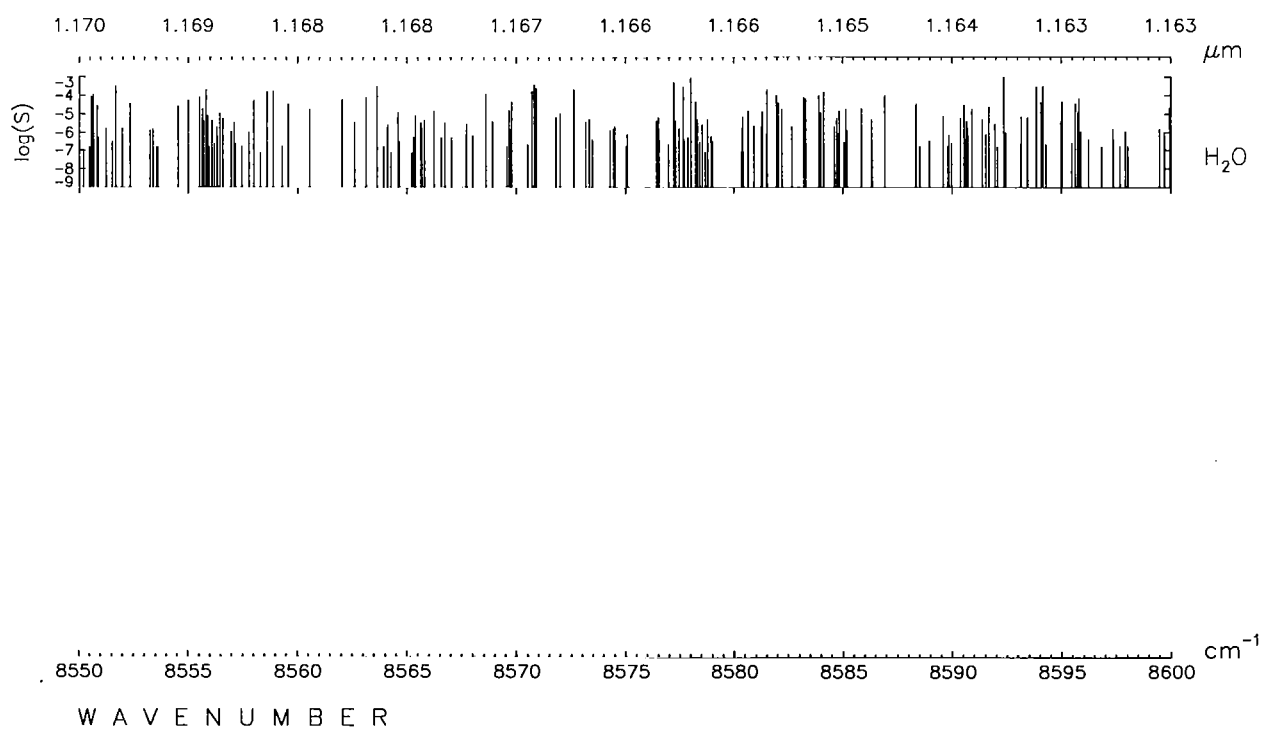
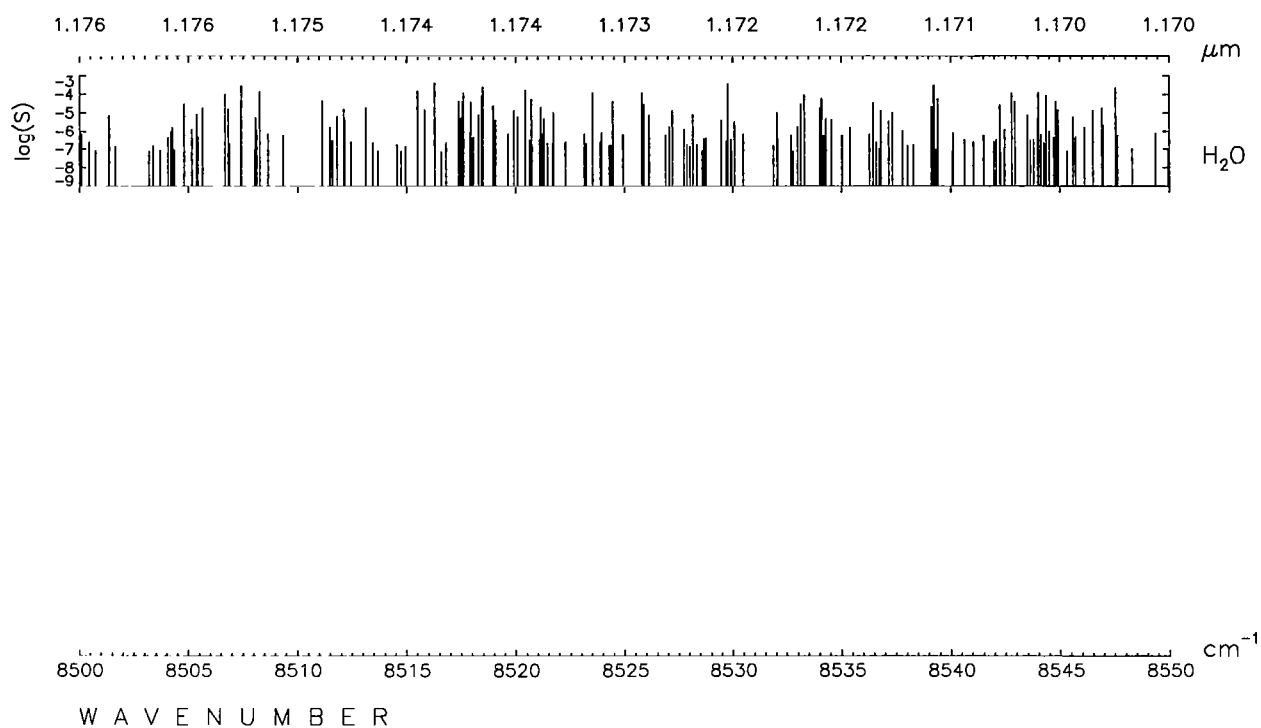


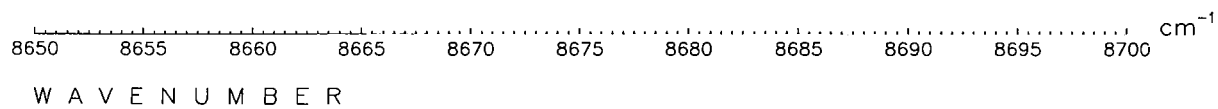
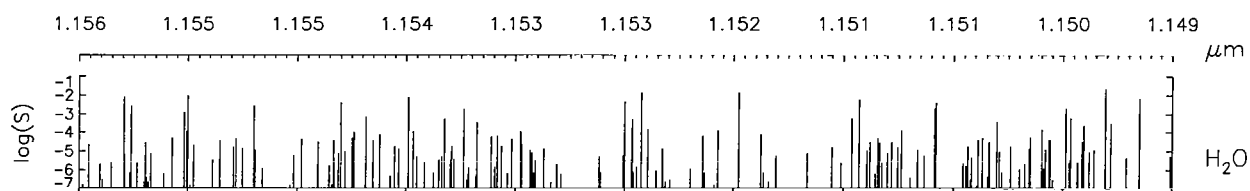
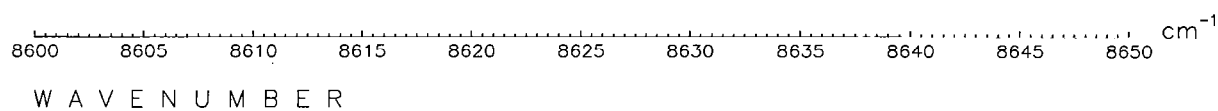
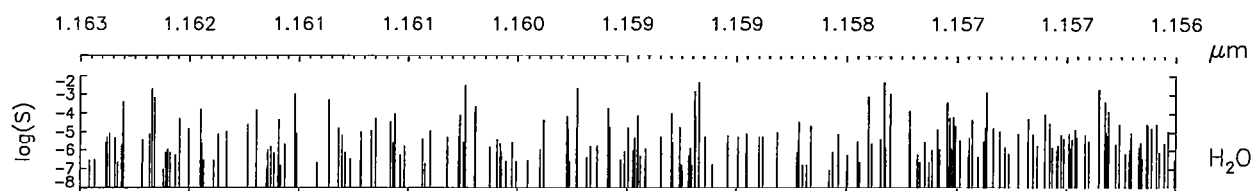
8250 8255 8260 8265 8270 8275 8280 8285 8290 8295 8300  $\text{cm}^{-1}$   
W A V E N U M B E R

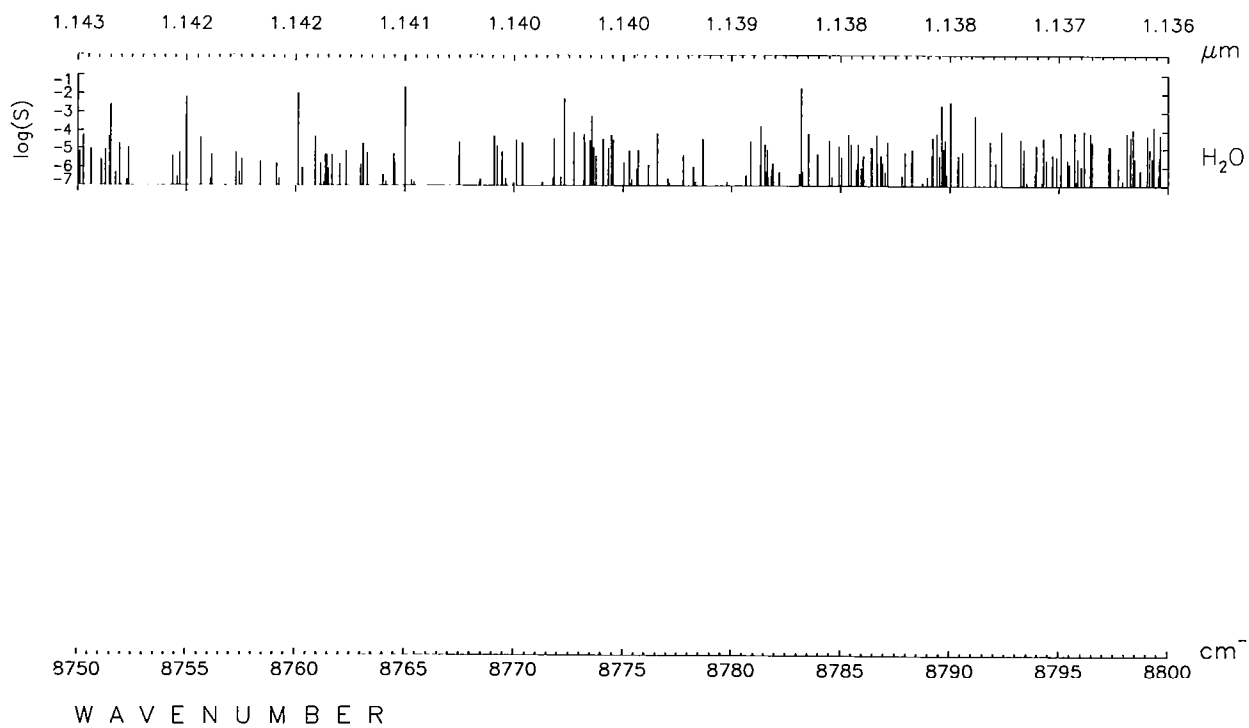
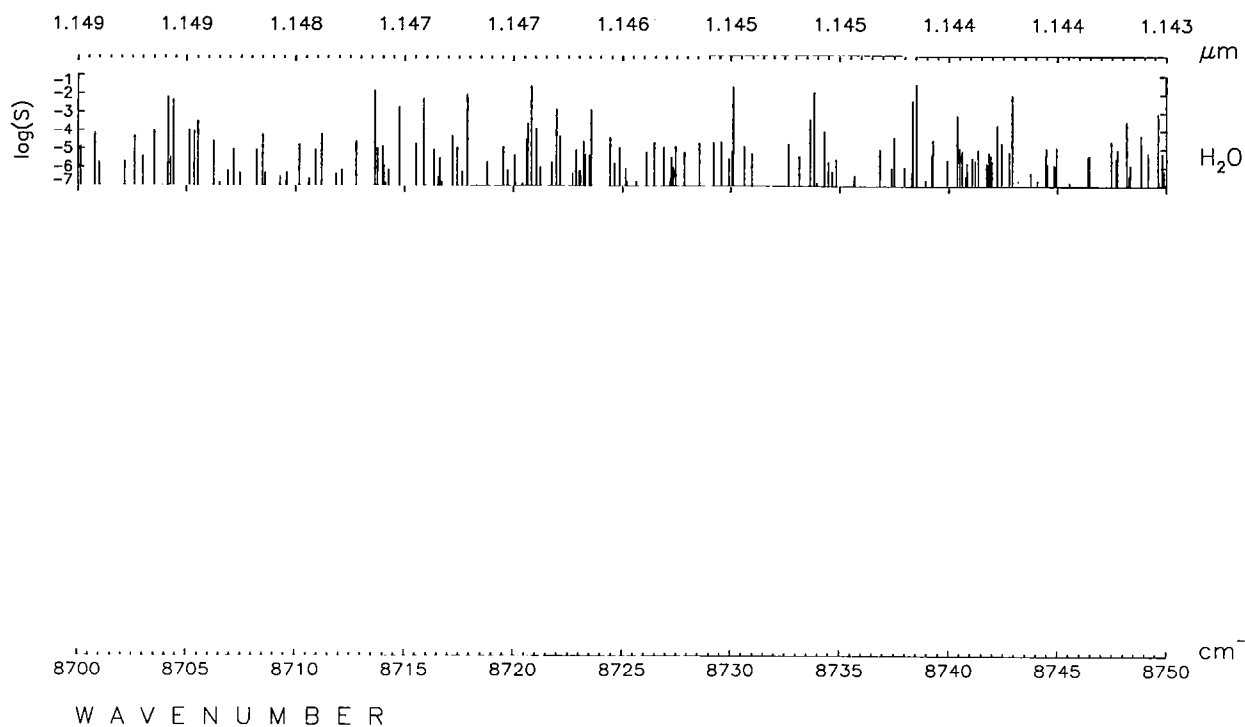


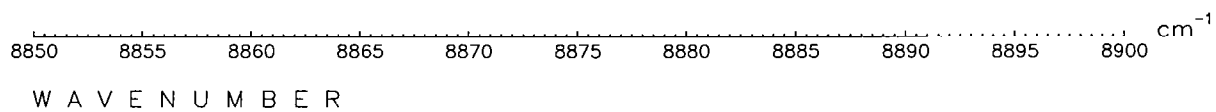
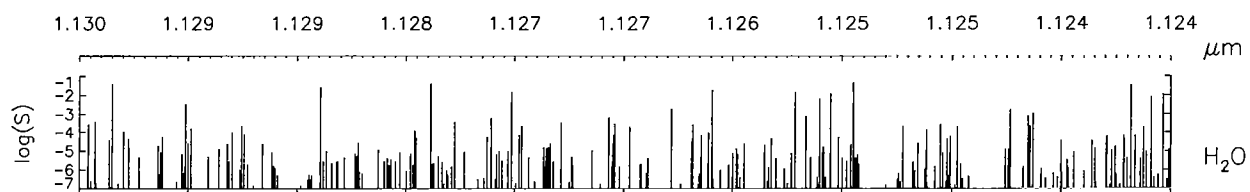
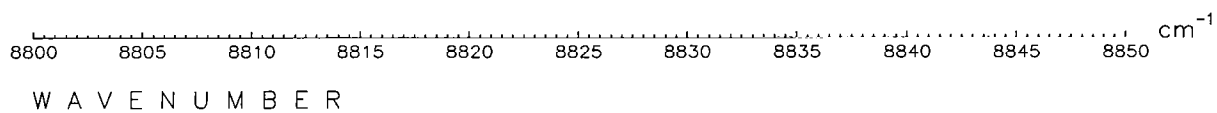
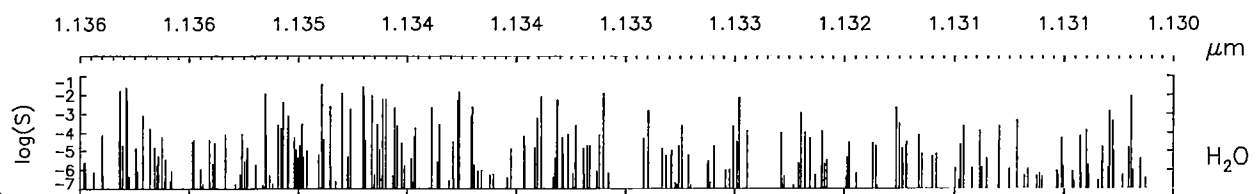


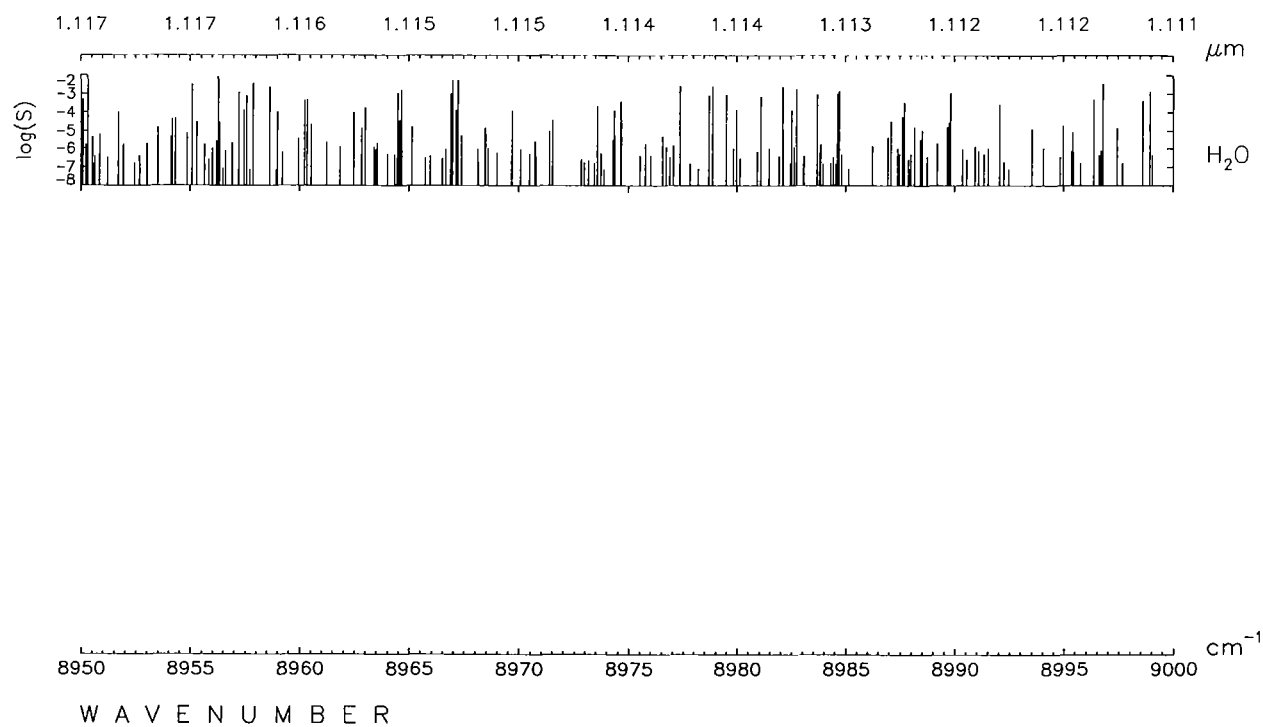
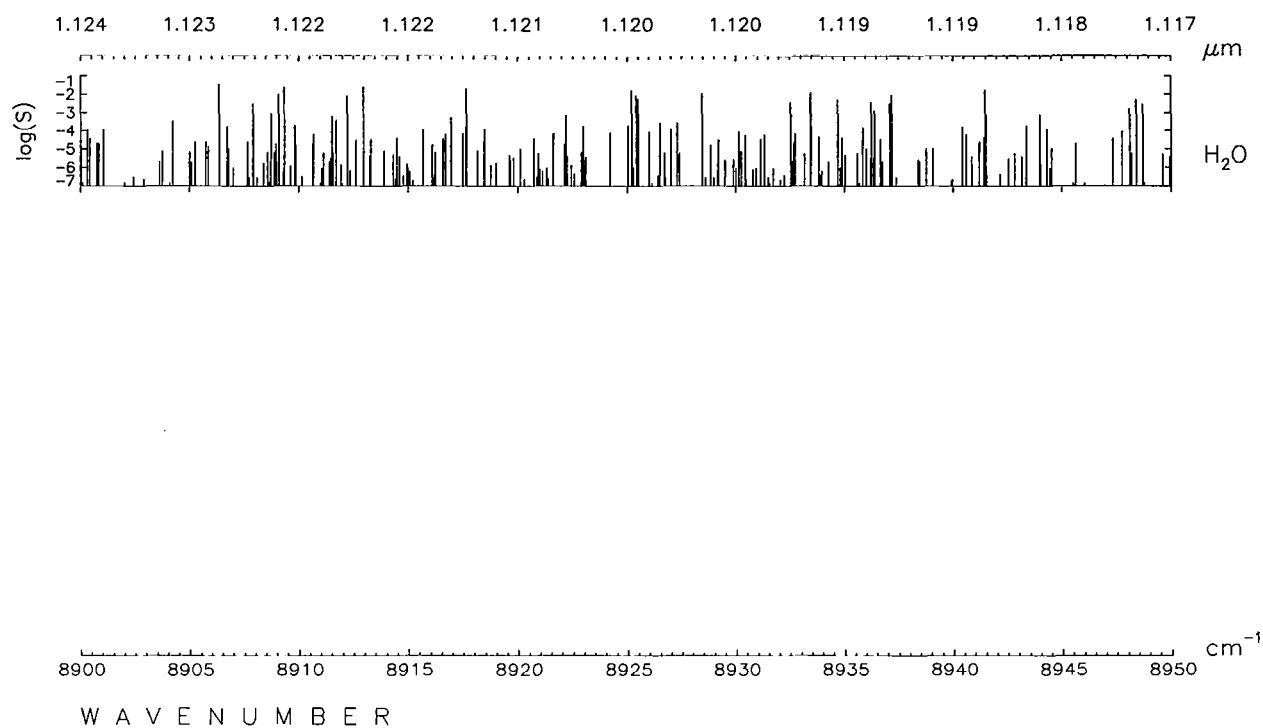


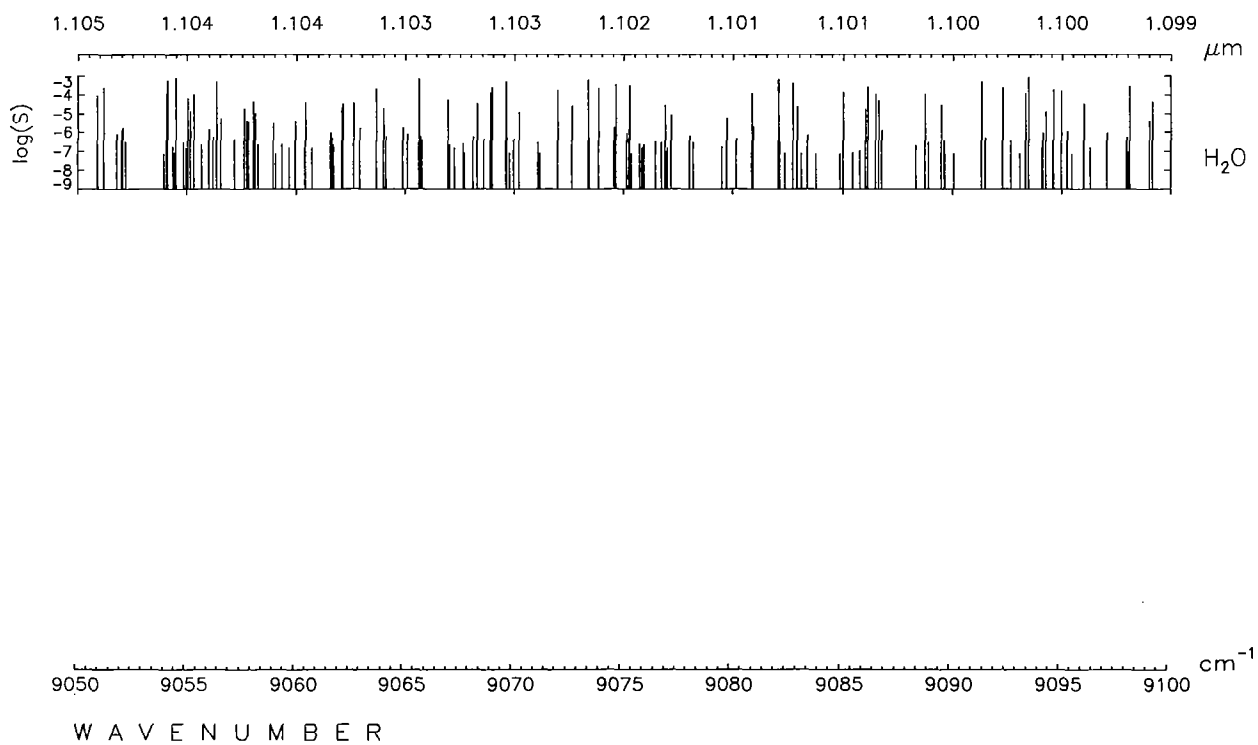
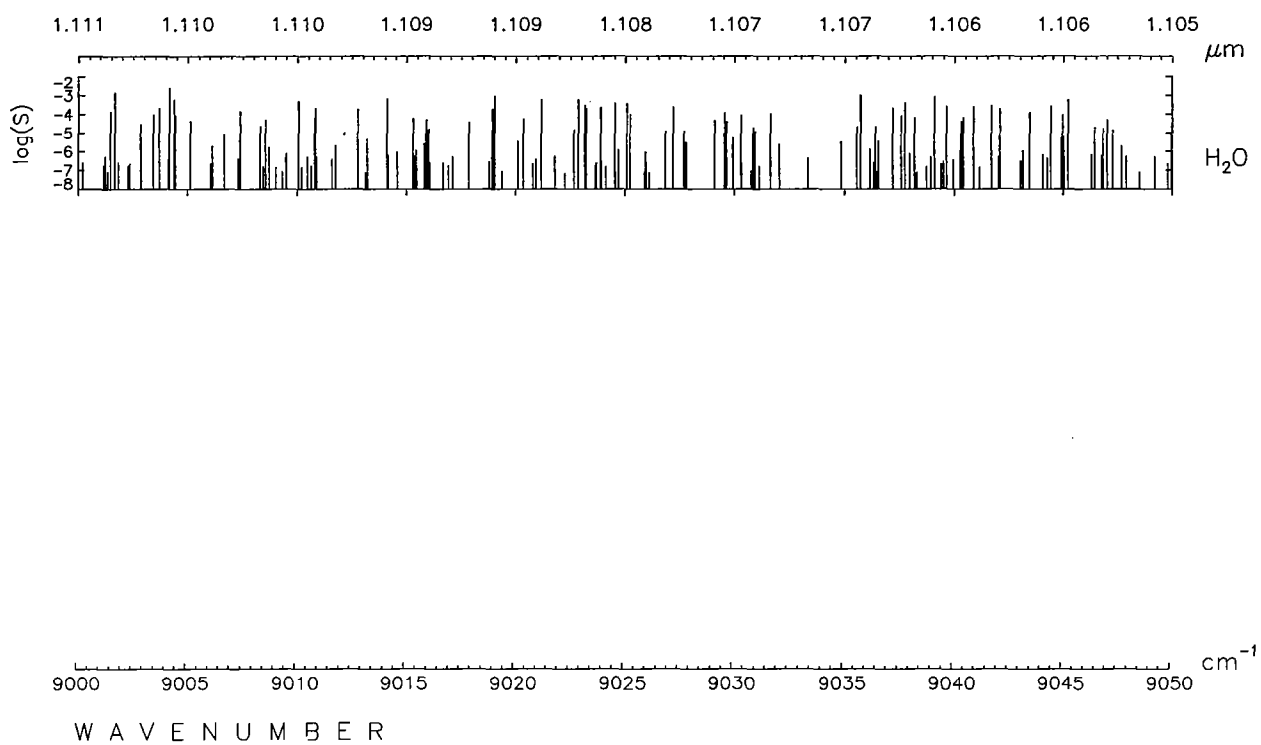


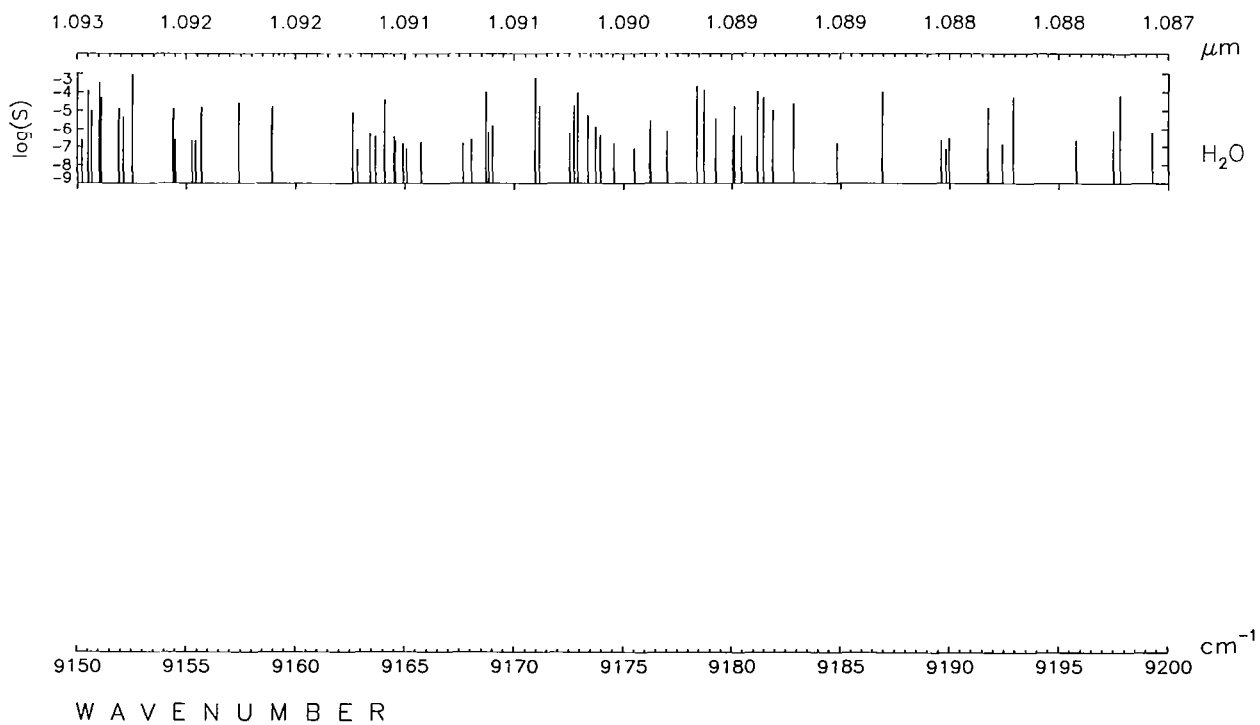
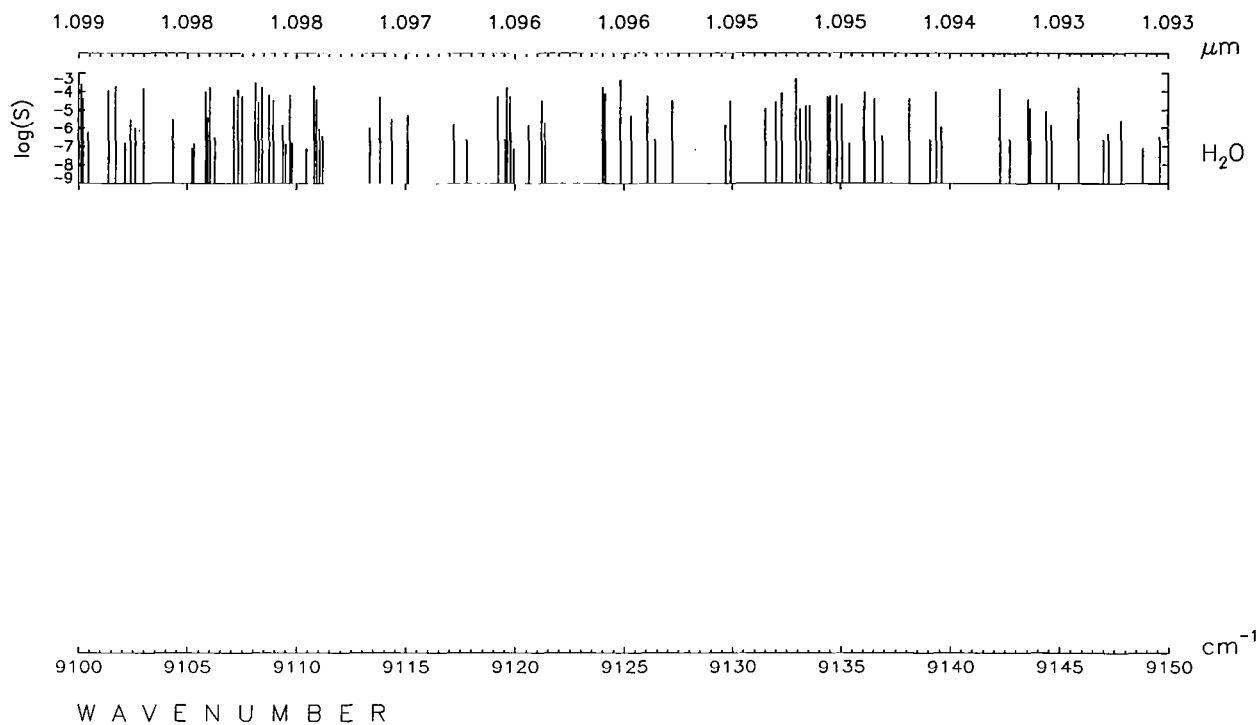




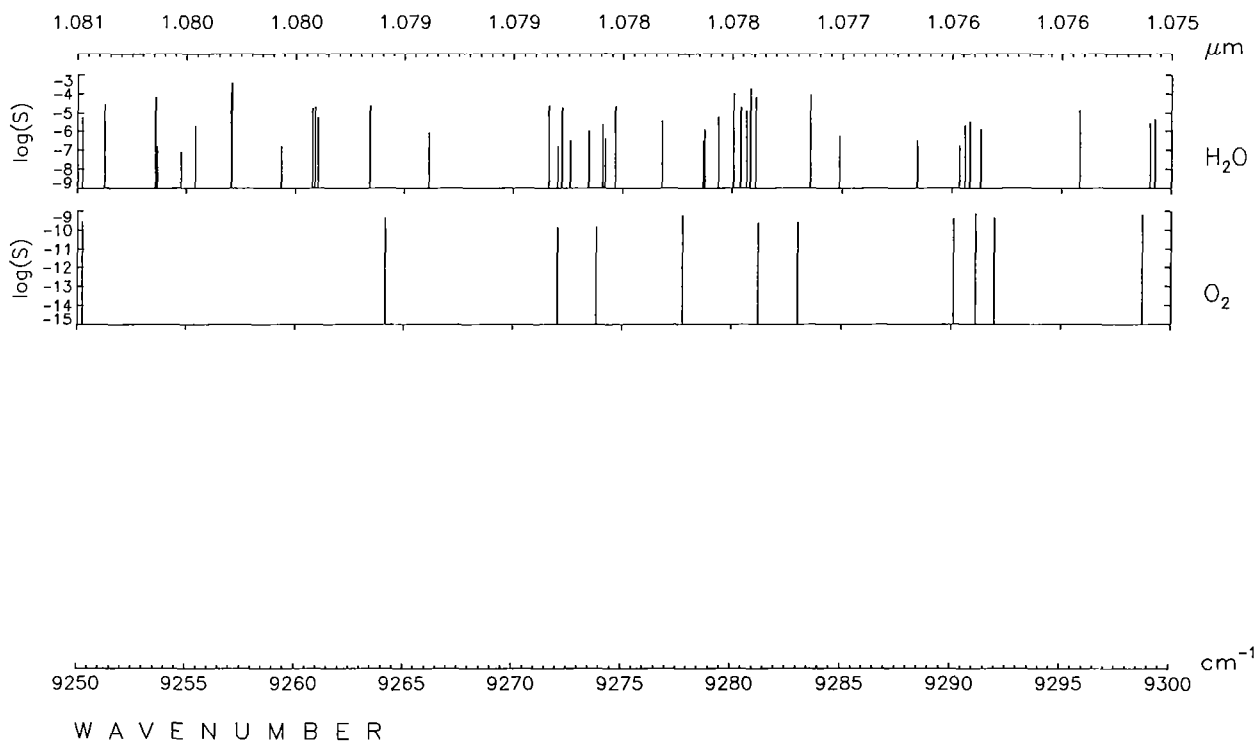
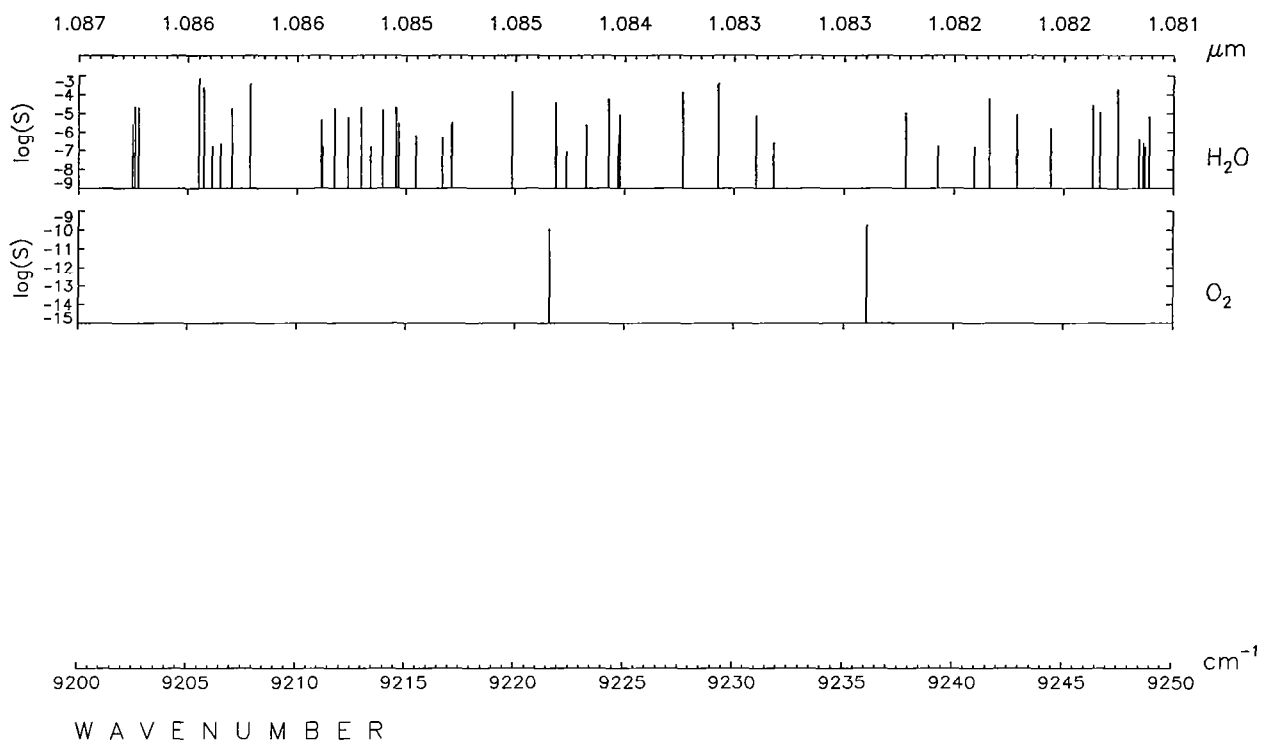


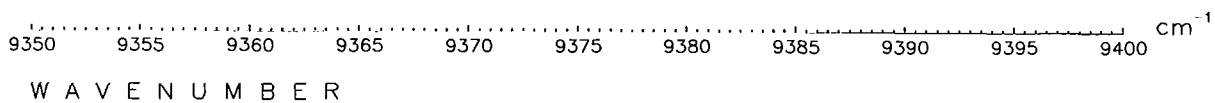
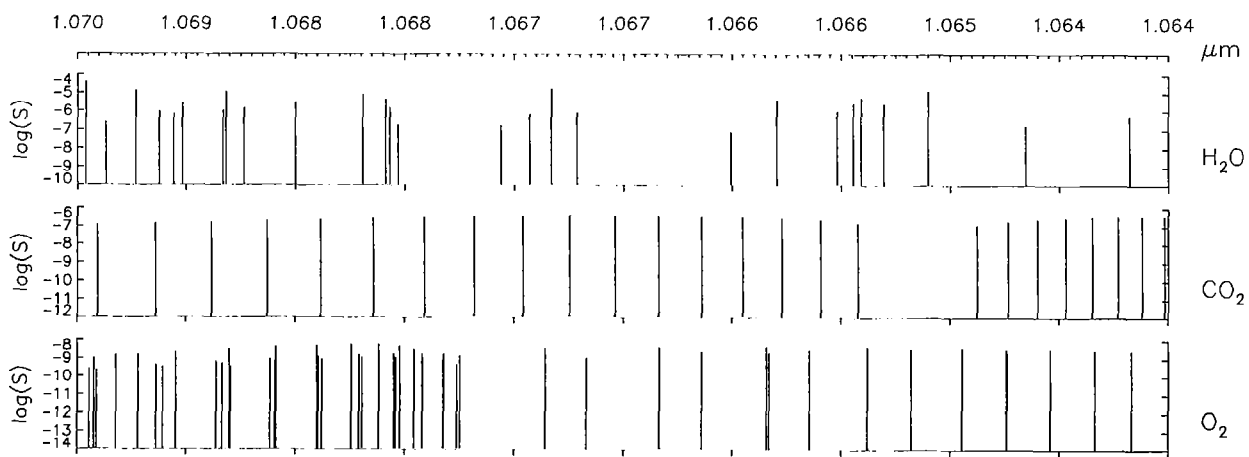
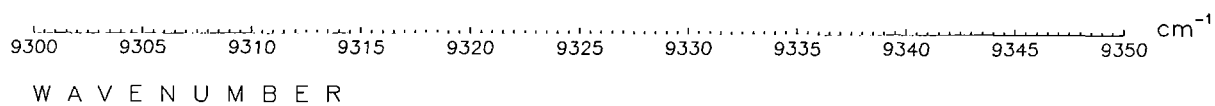
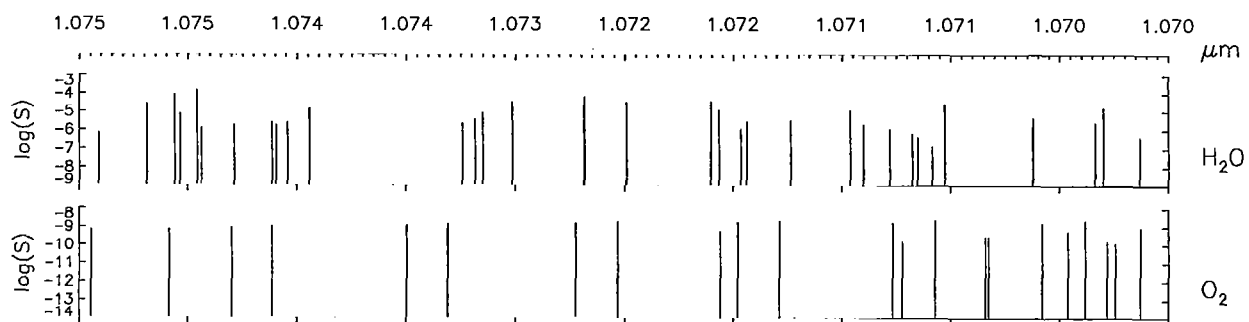


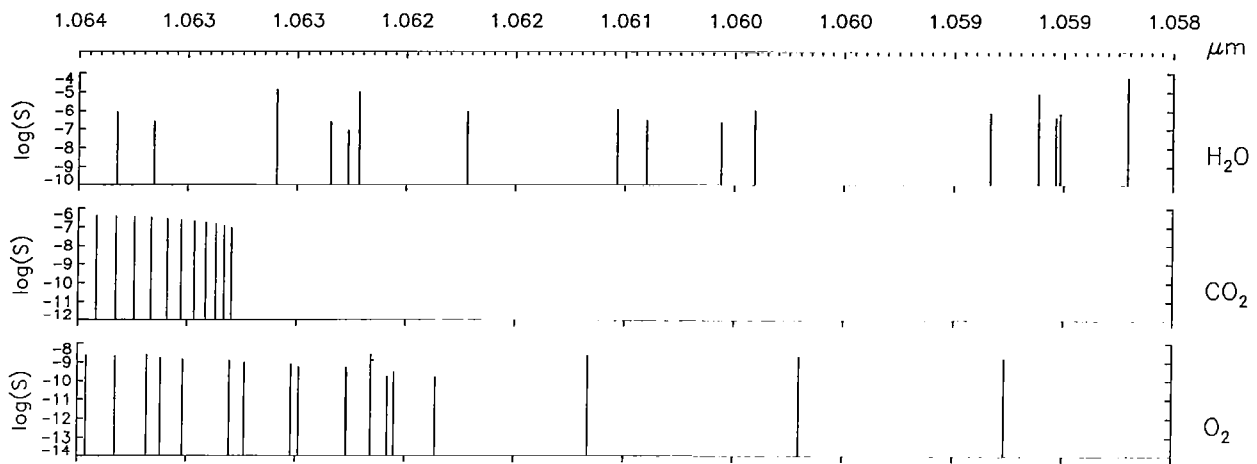




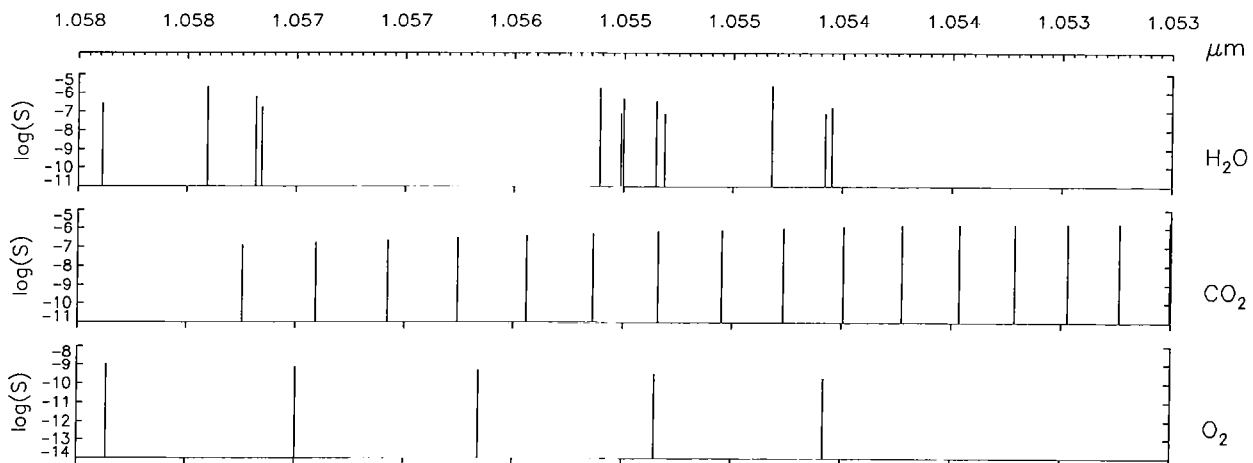




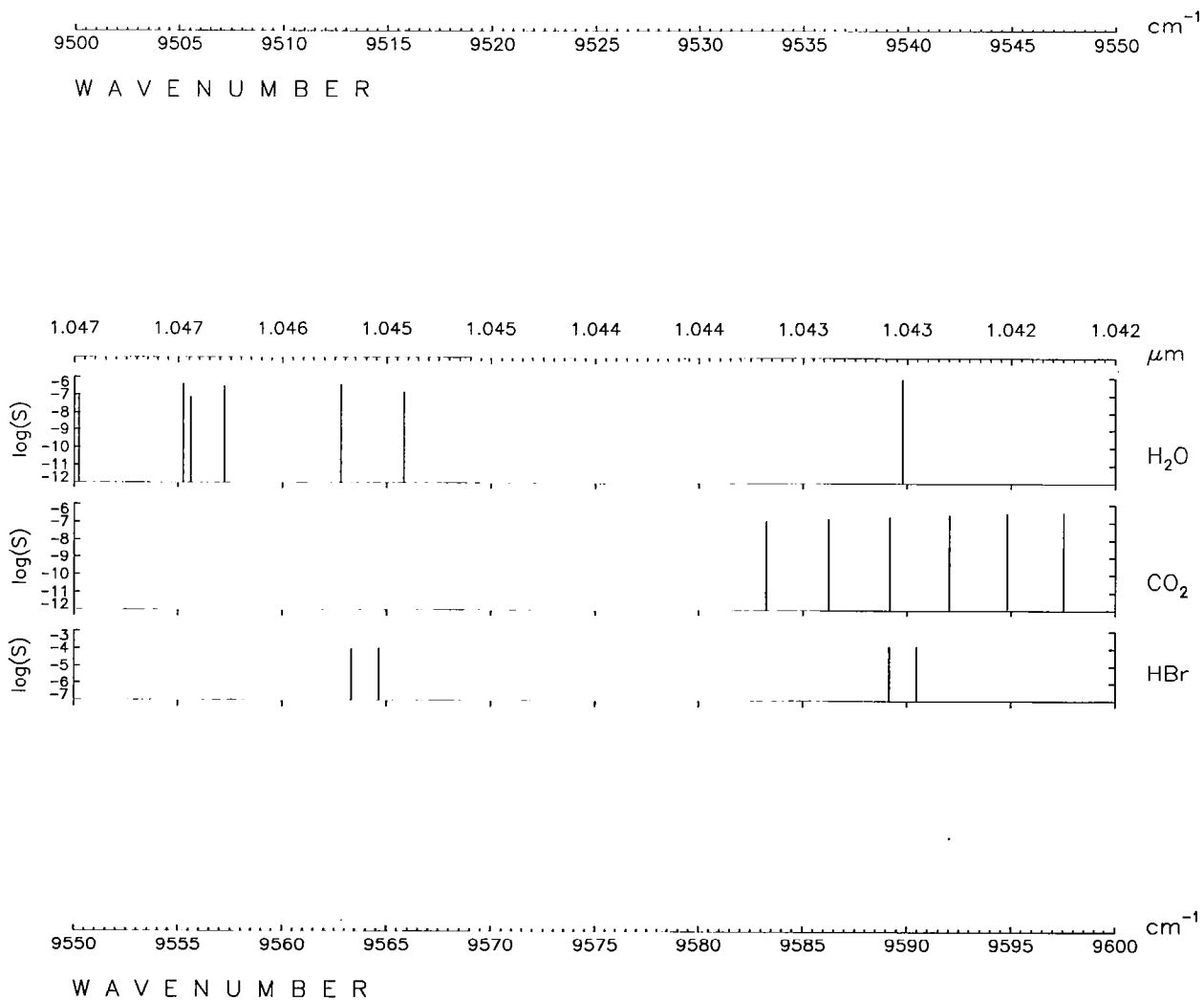
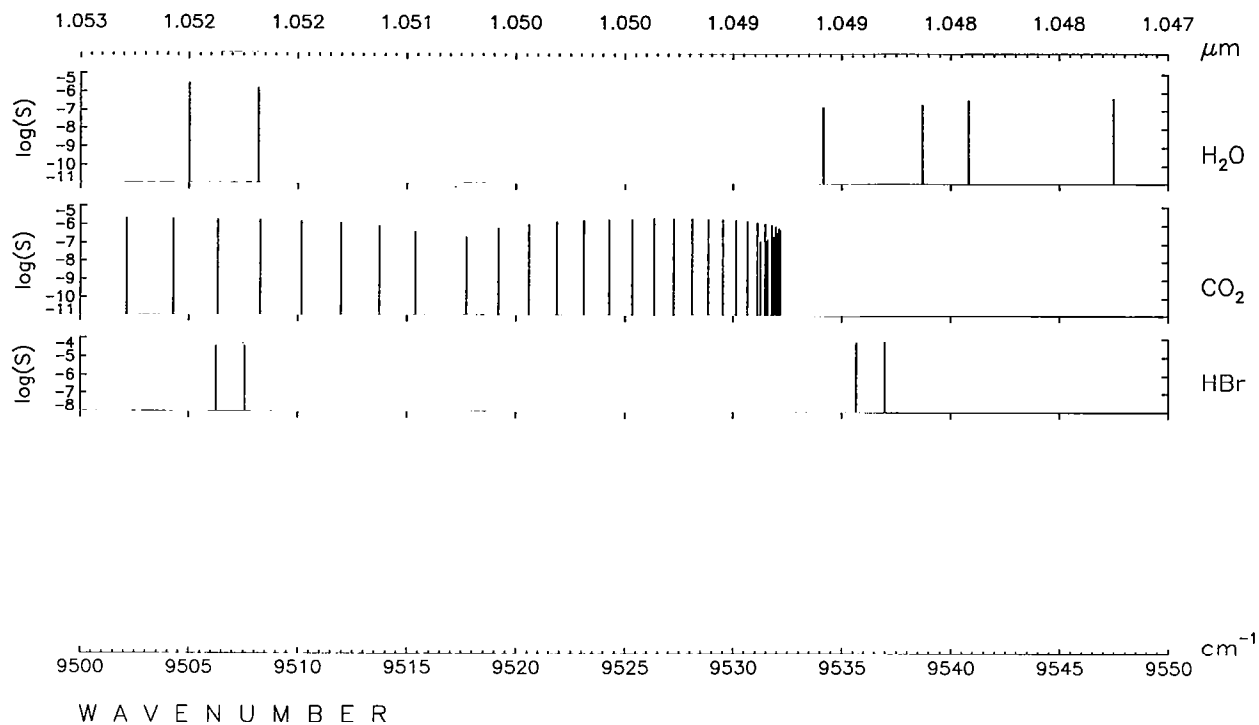


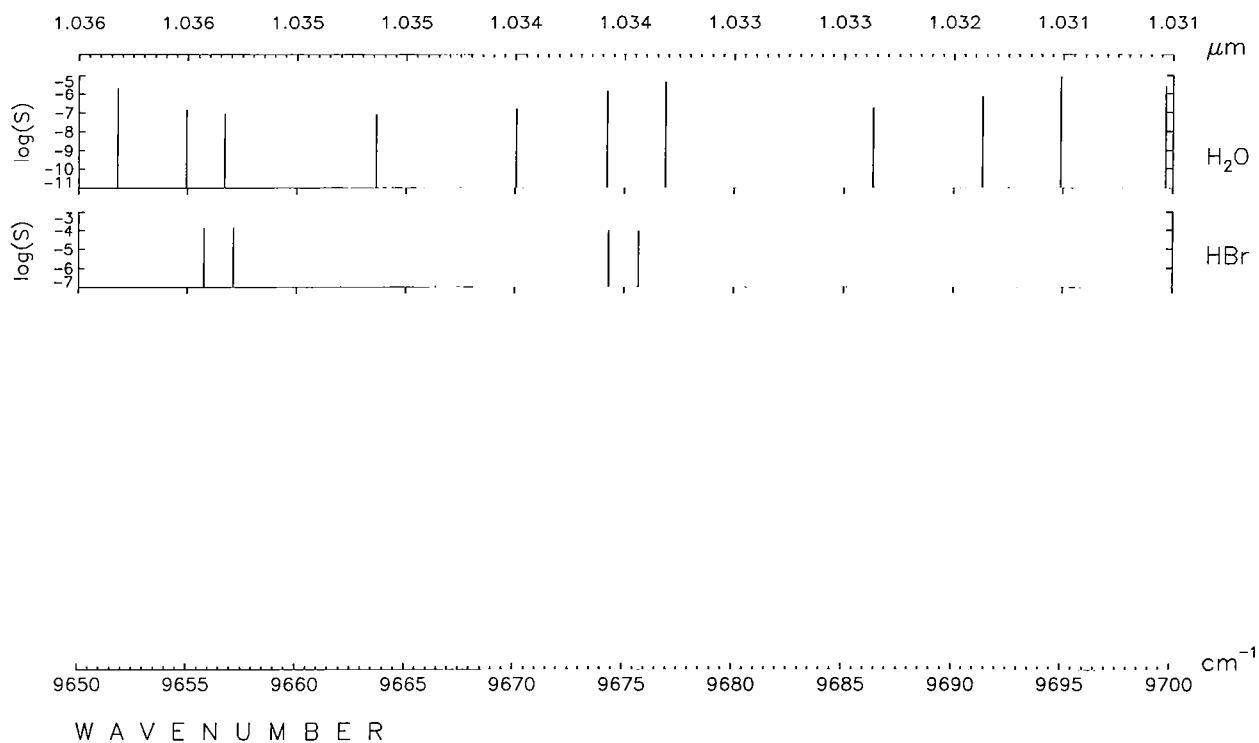
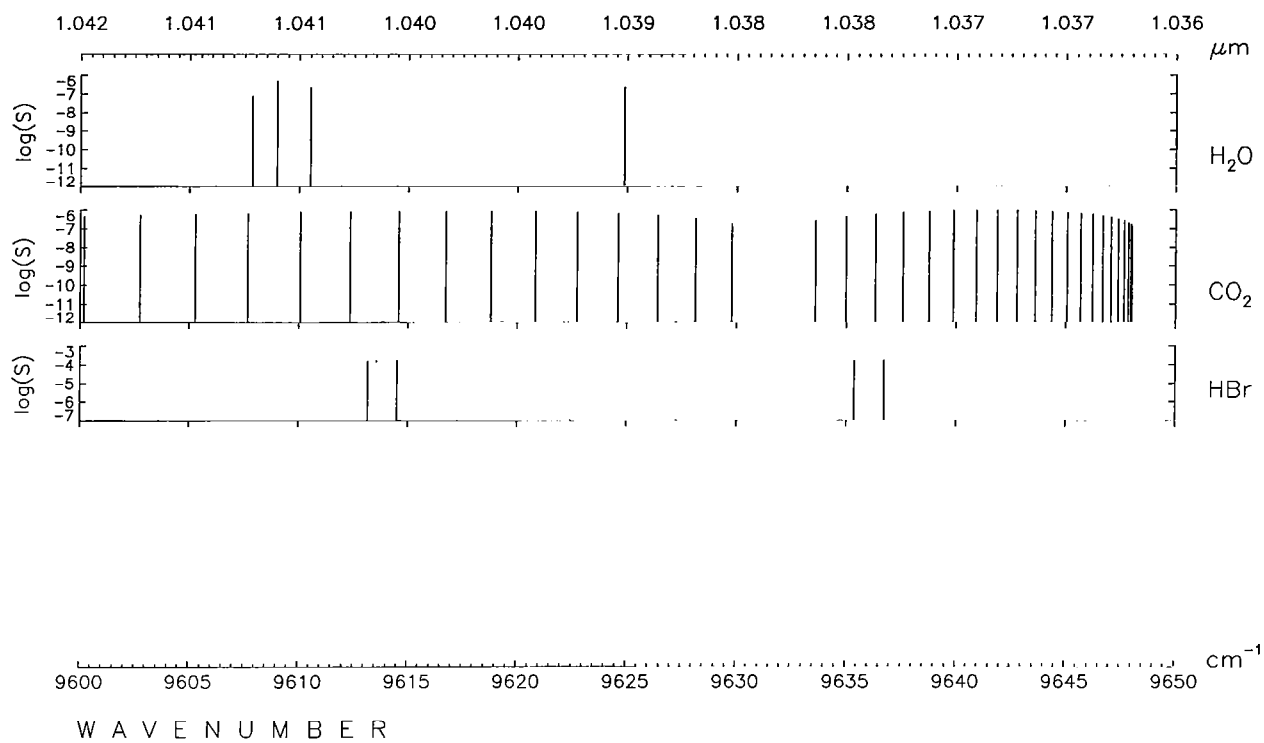


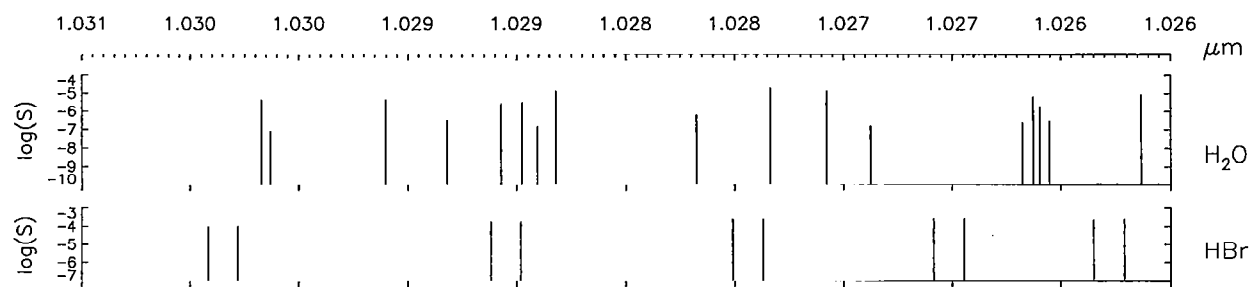
W A V E N U M B E R  $\text{cm}^{-1}$



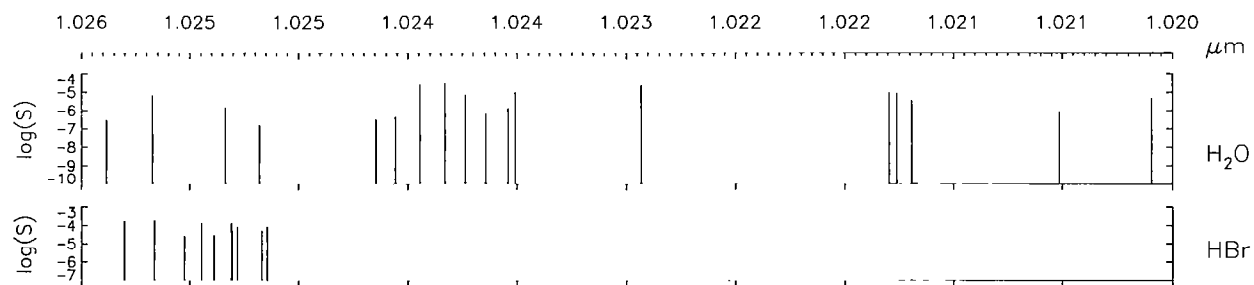
W A V E N U M B E R  $\text{cm}^{-1}$



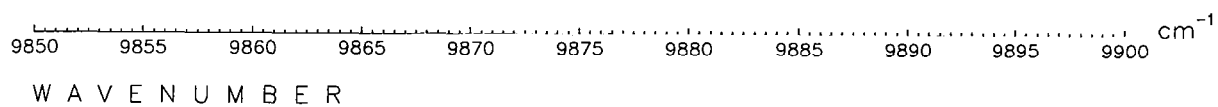
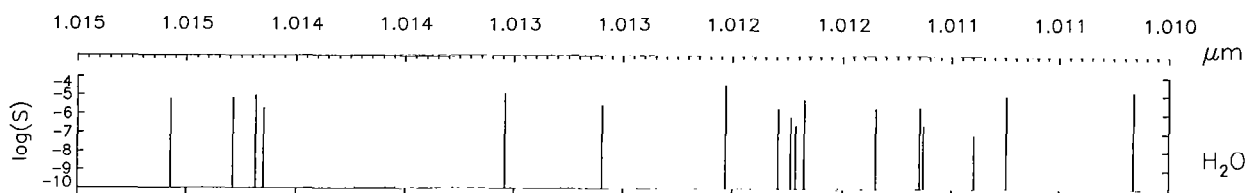
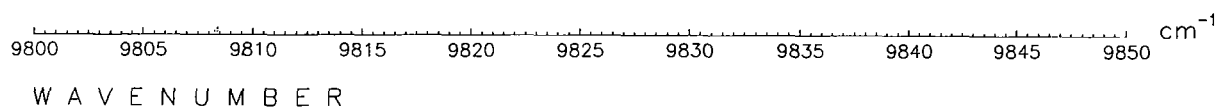
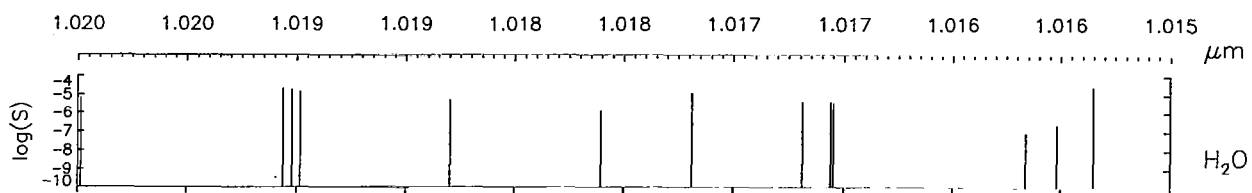


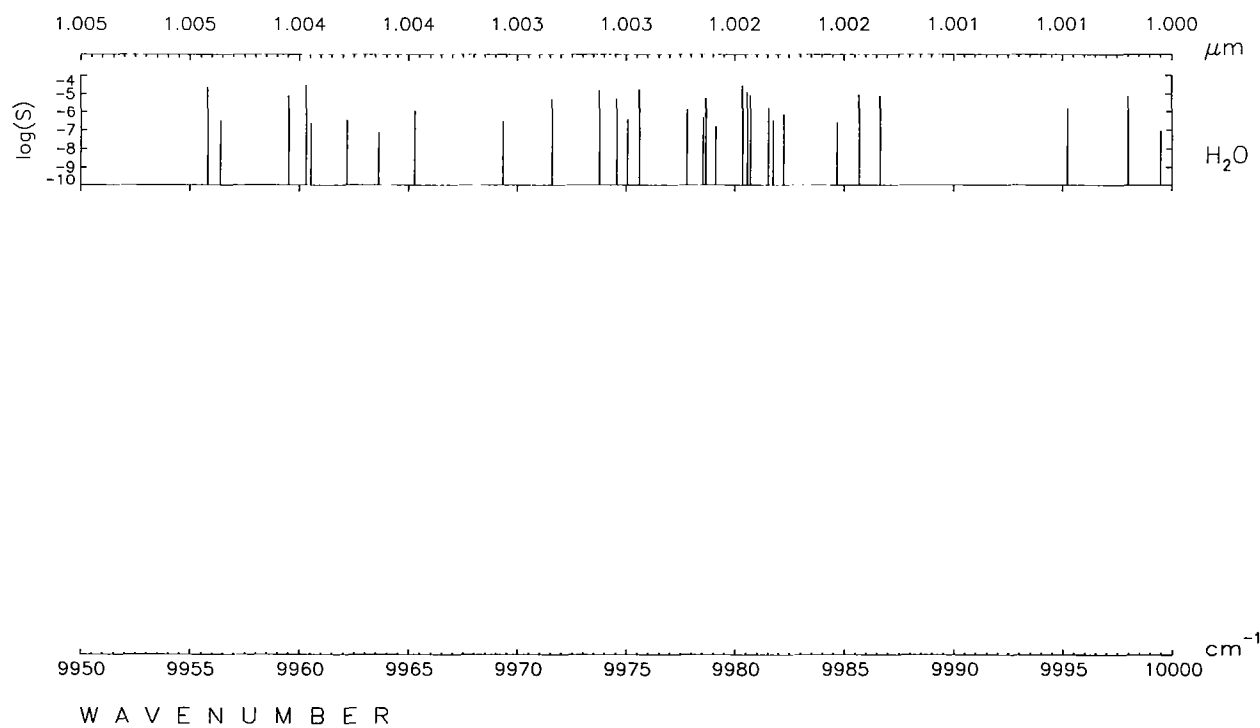
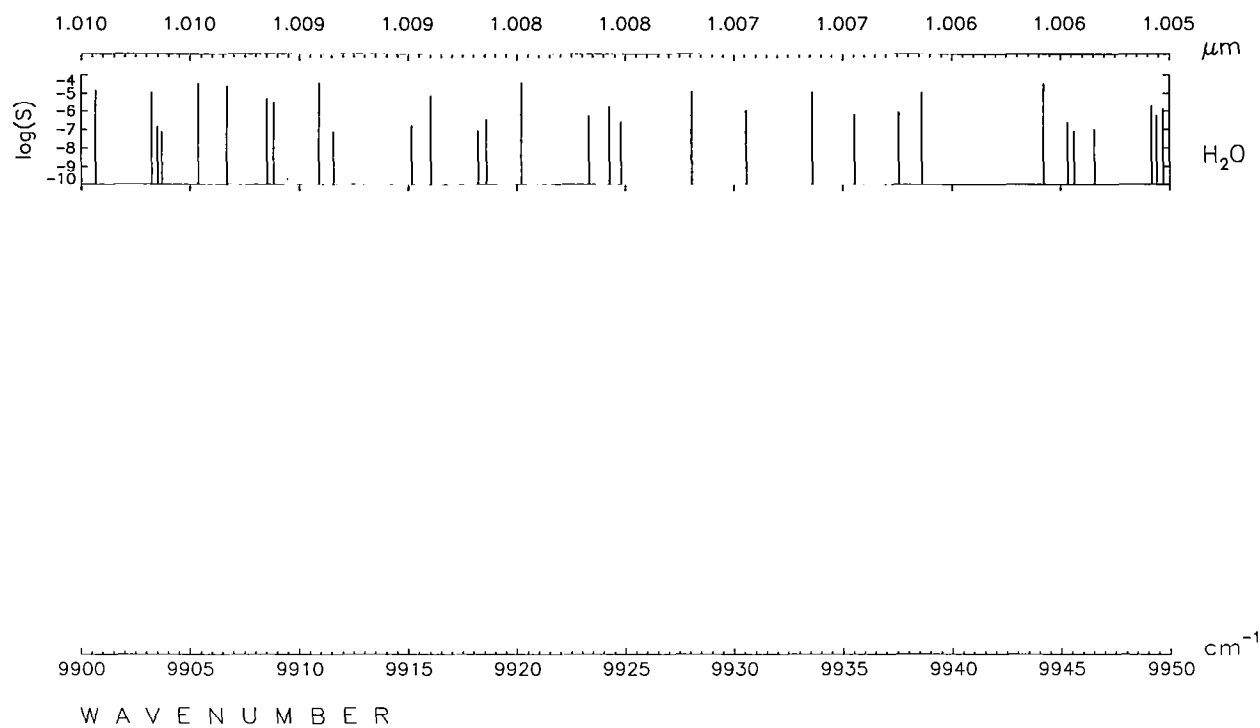


W A V E N U M B E R  $\text{cm}^{-1}$

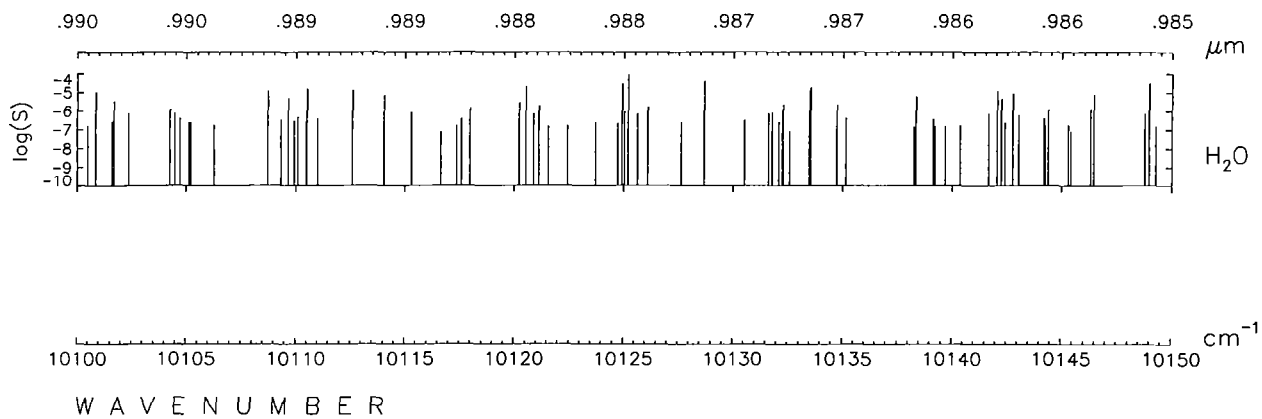
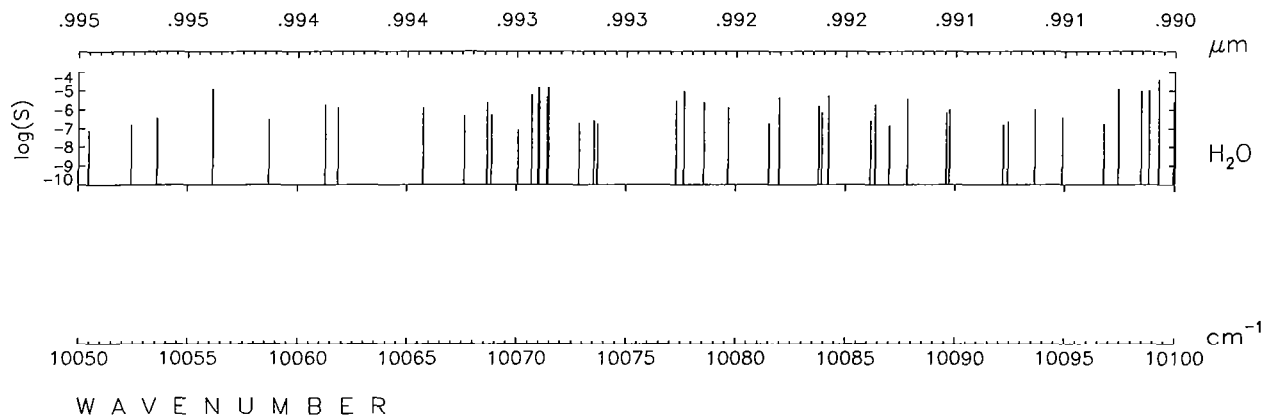
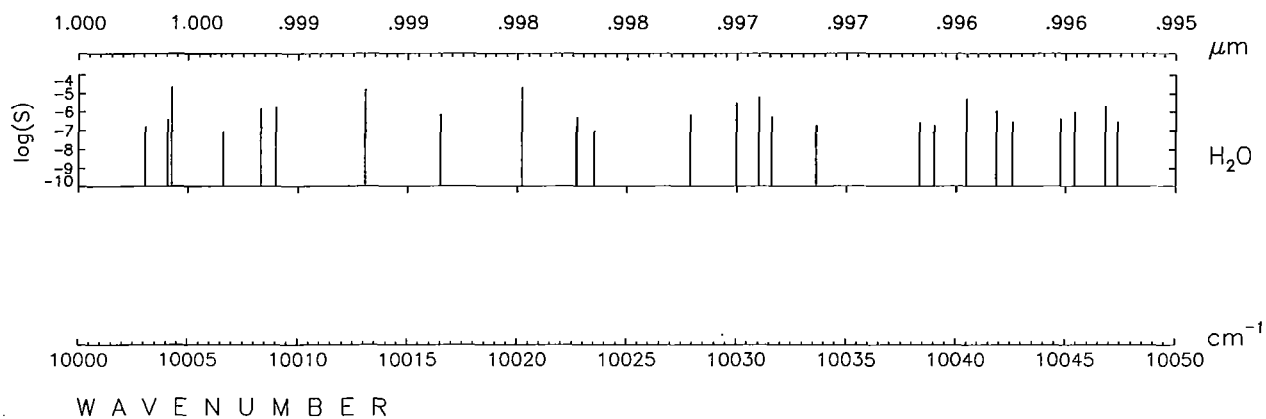


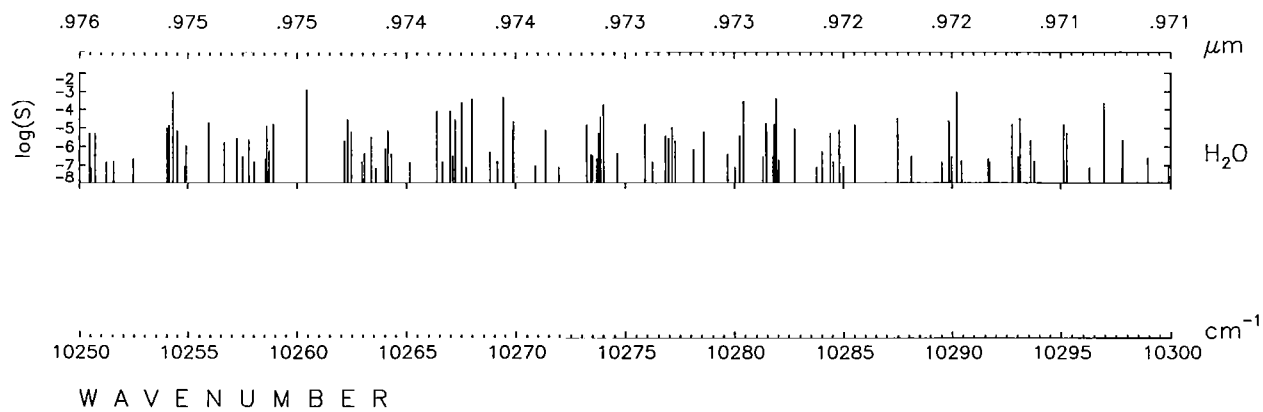
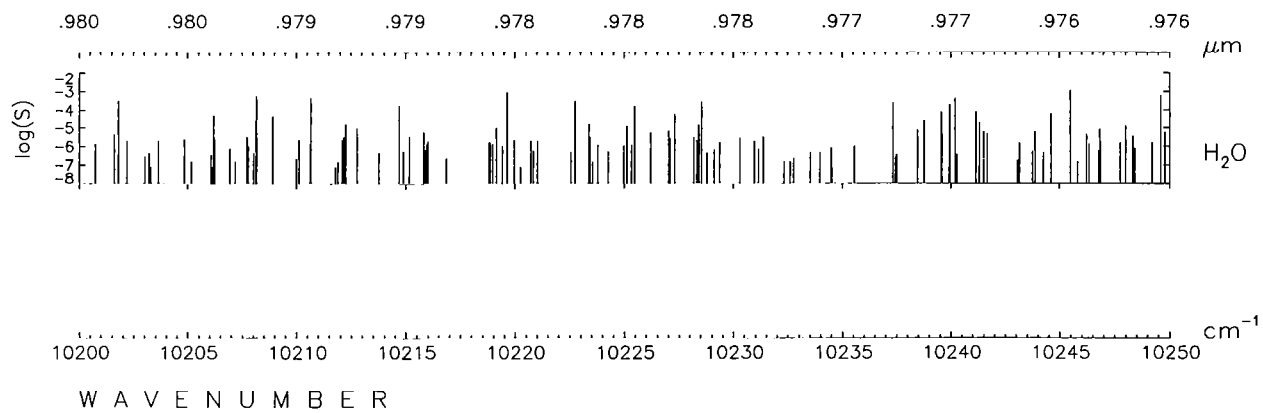
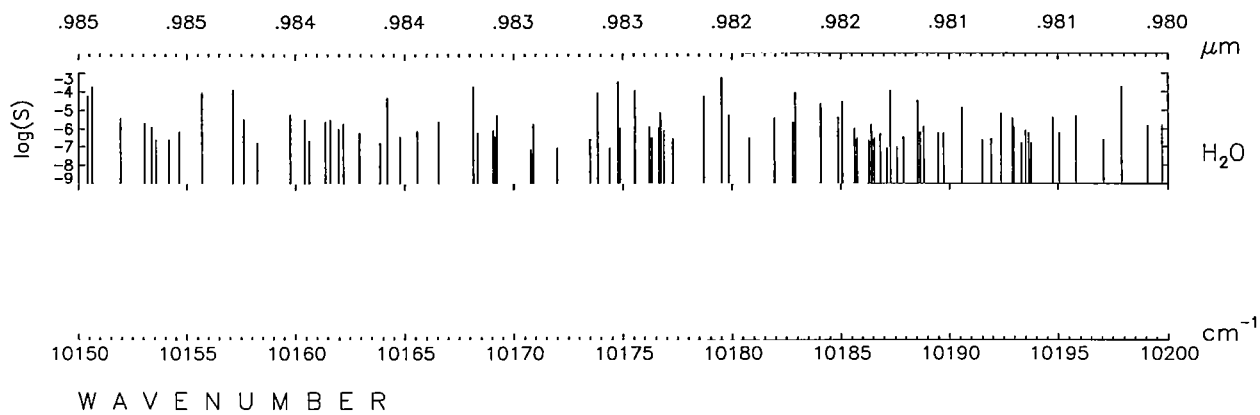
W A V E N U M B E R  $\text{cm}^{-1}$

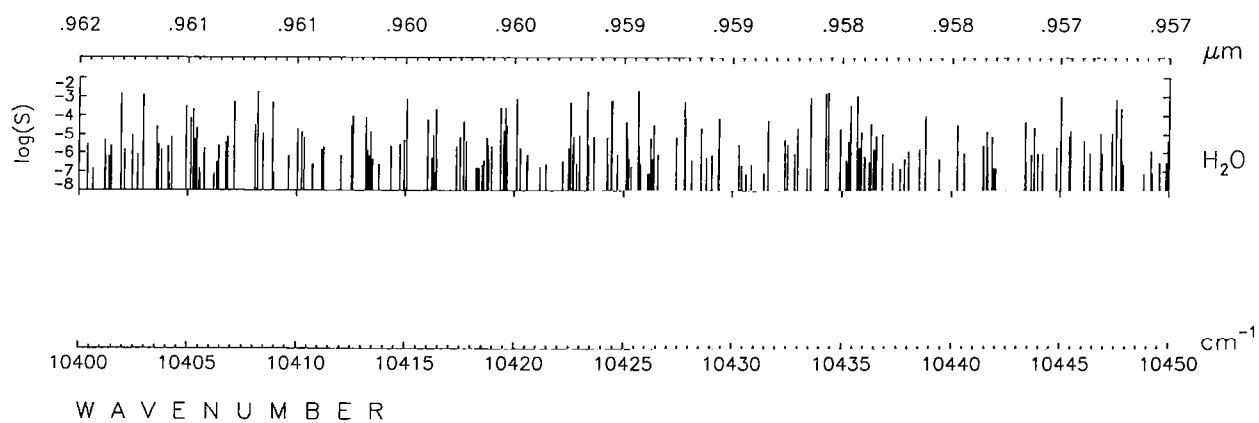
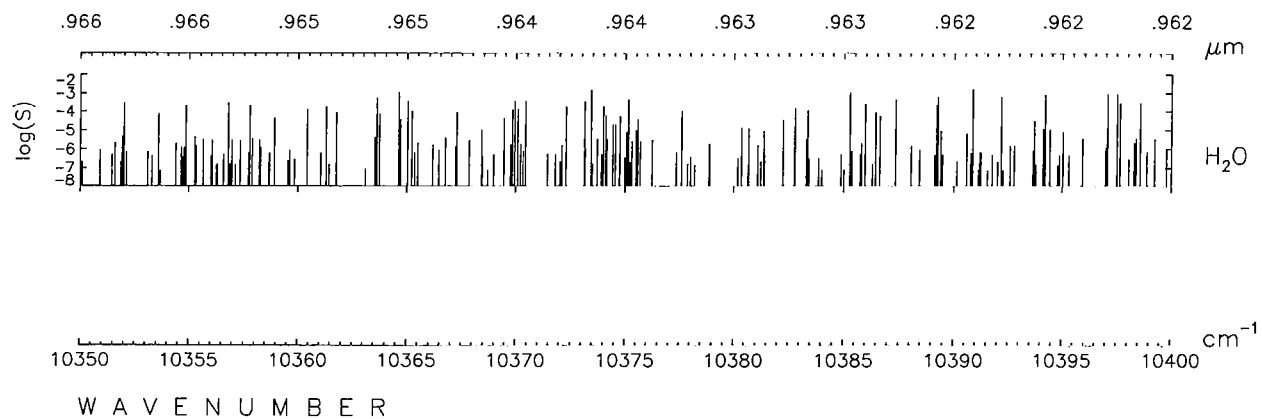
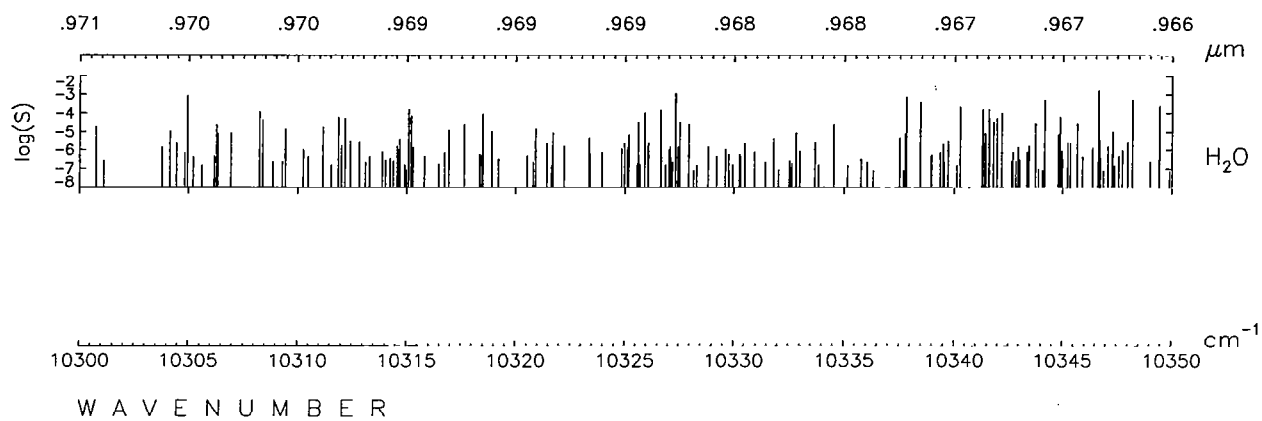


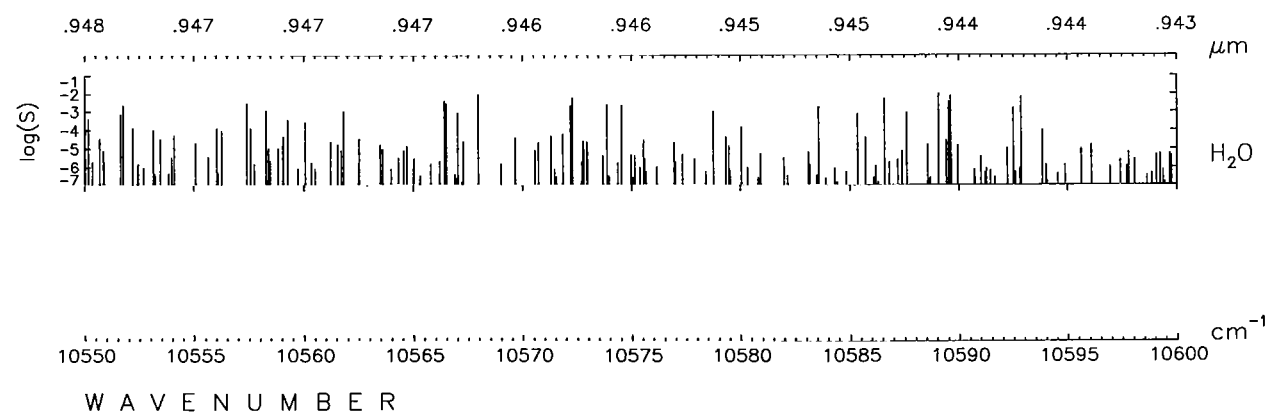
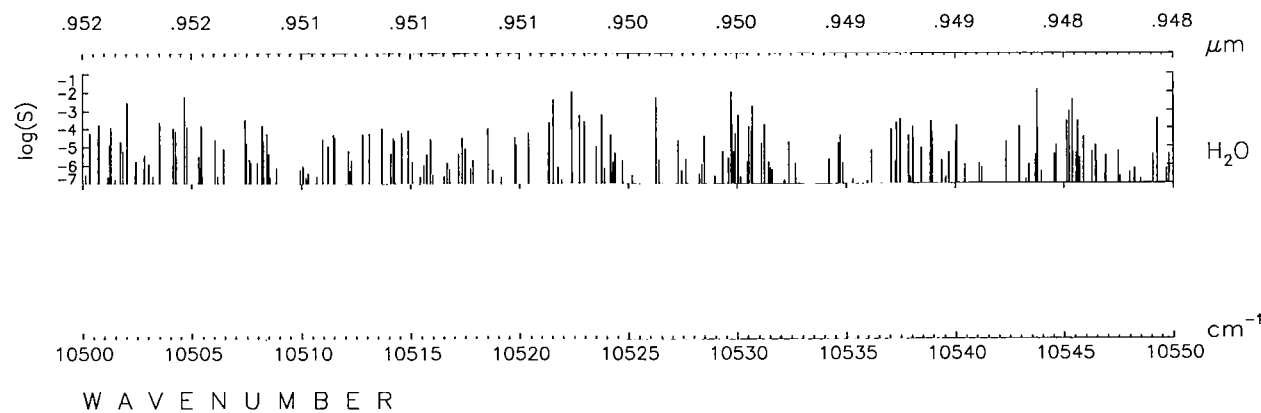
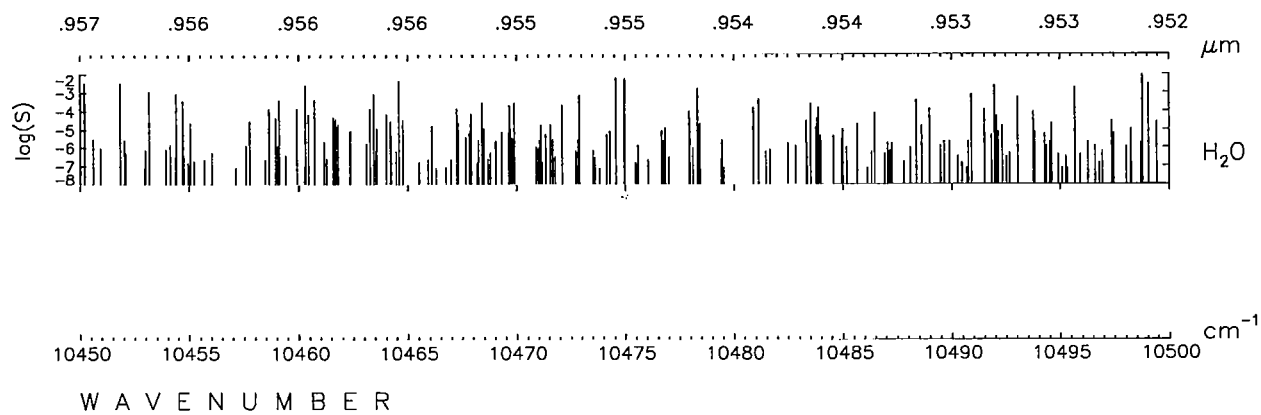


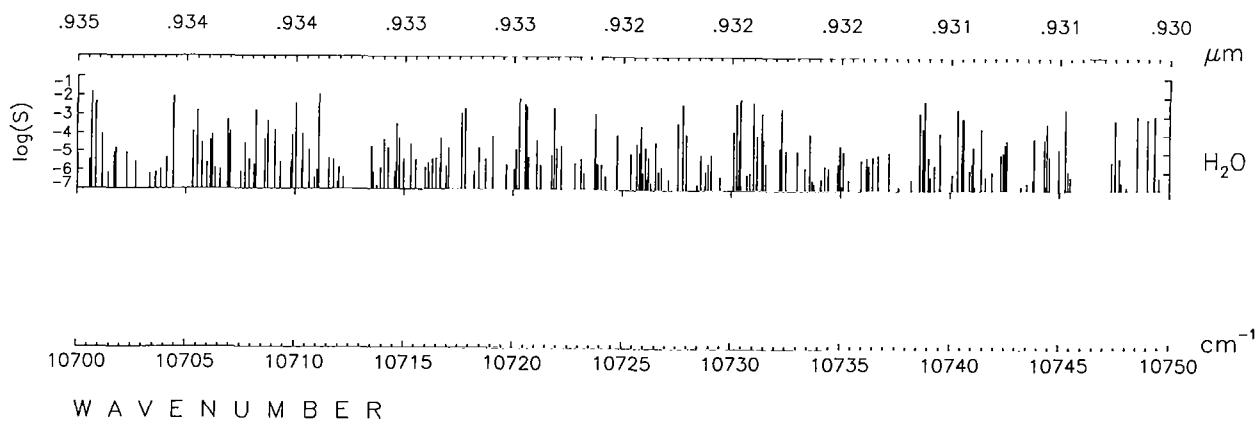
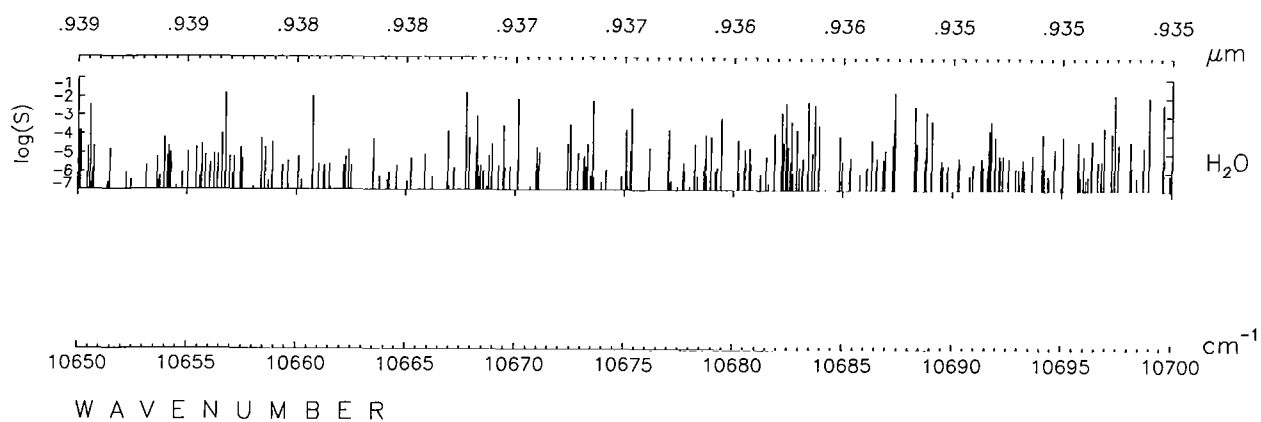
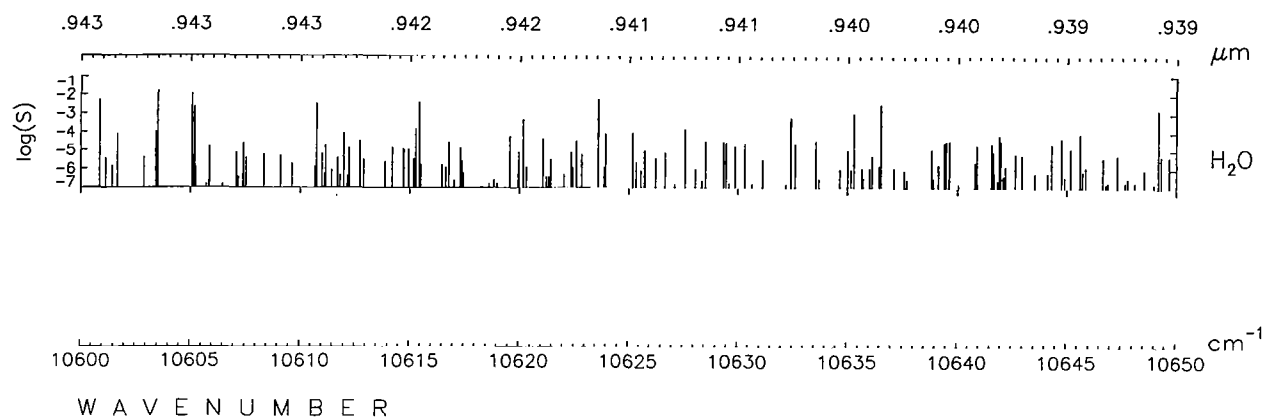


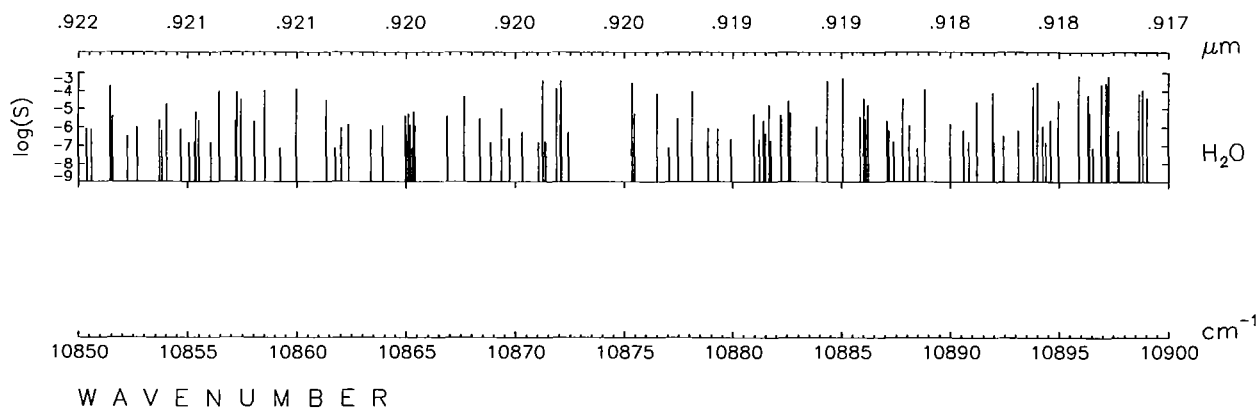
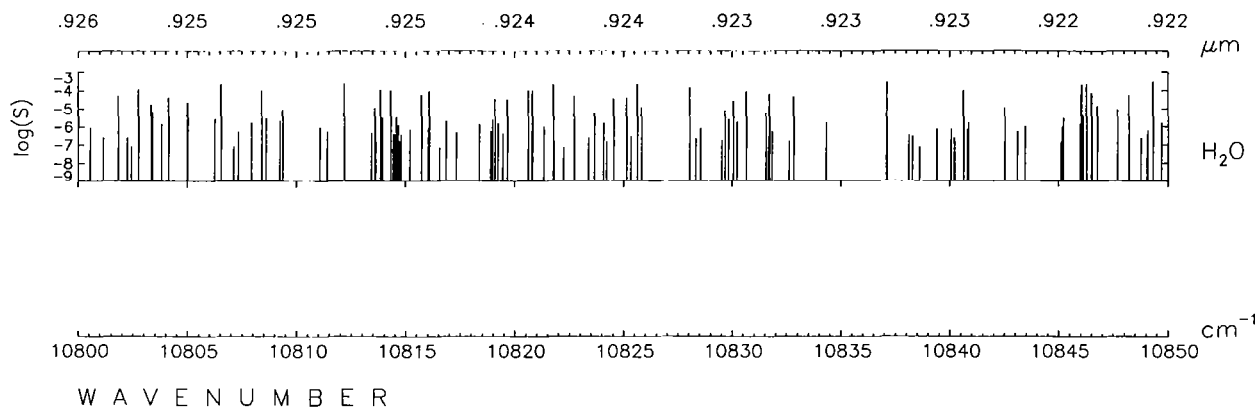
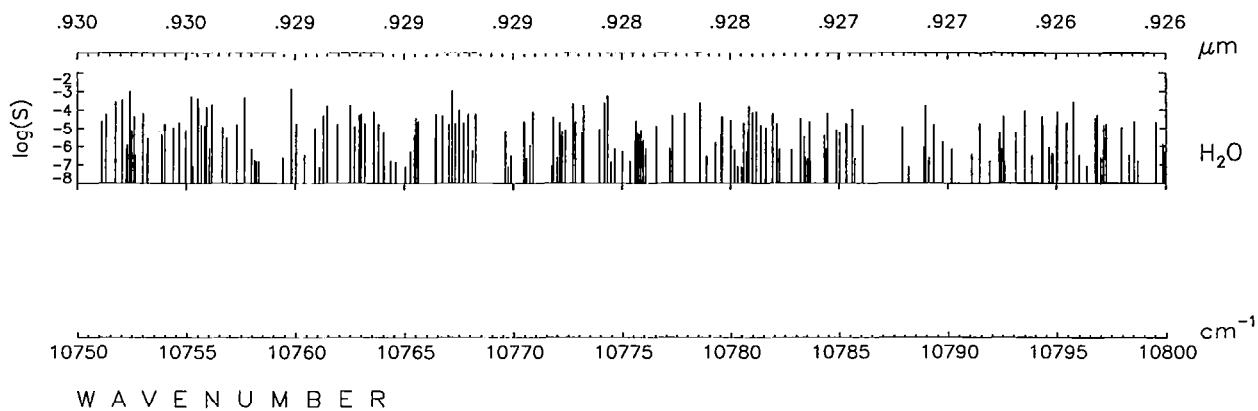


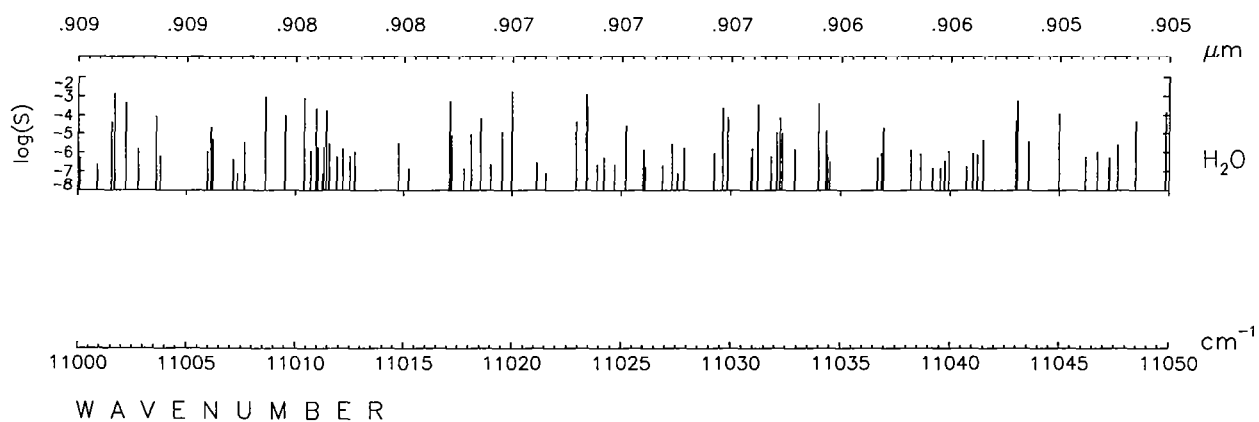
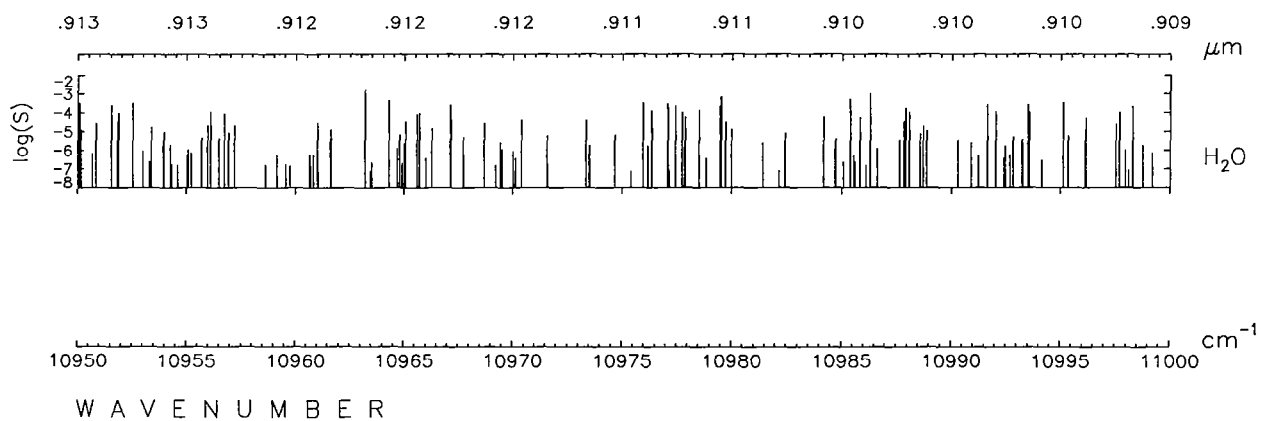
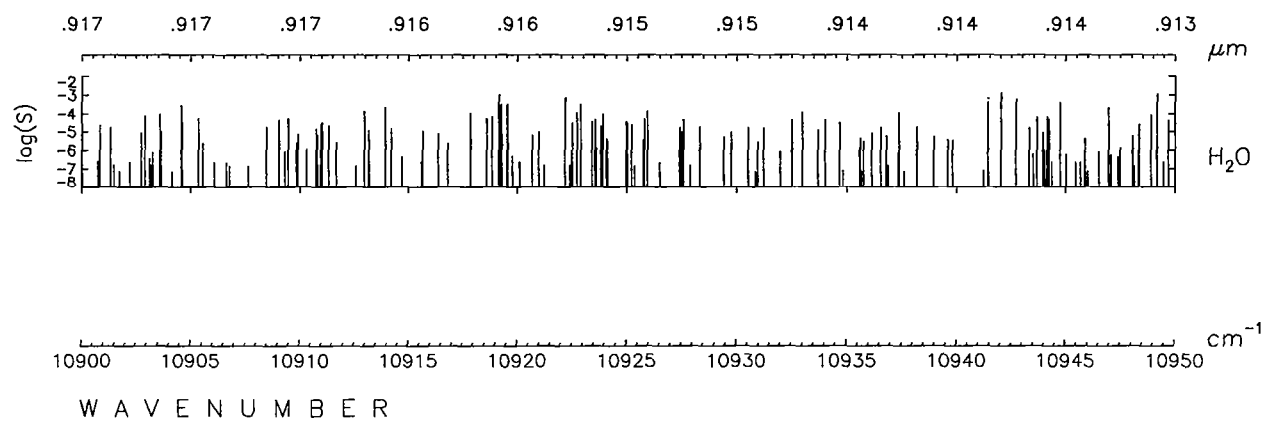


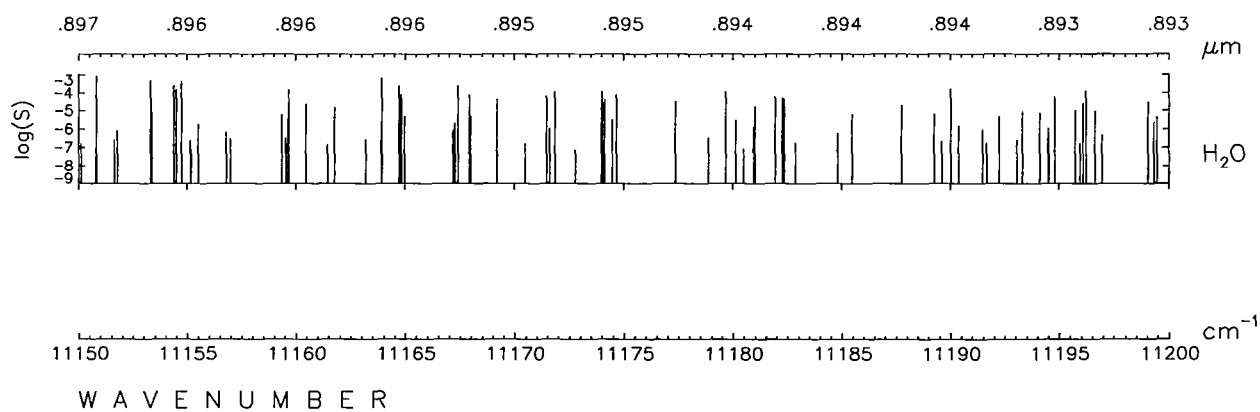
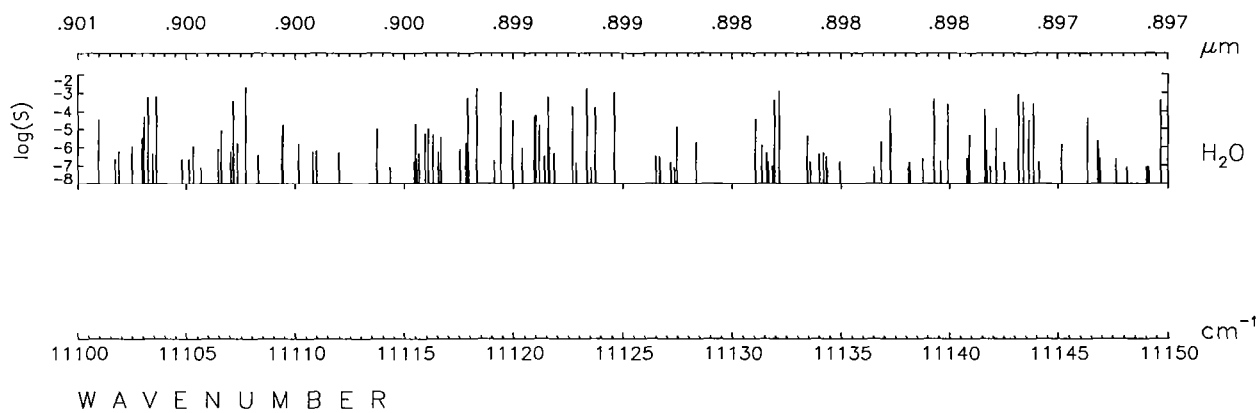
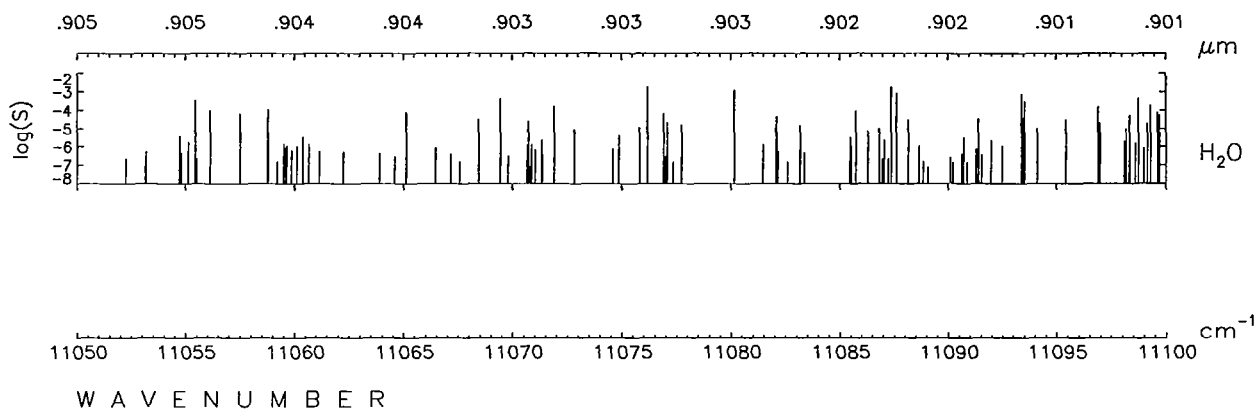




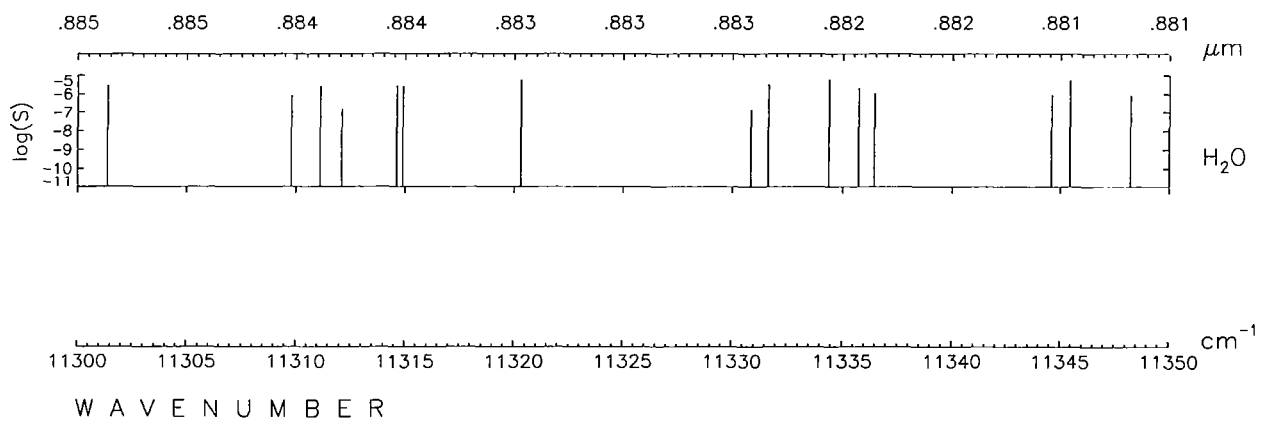
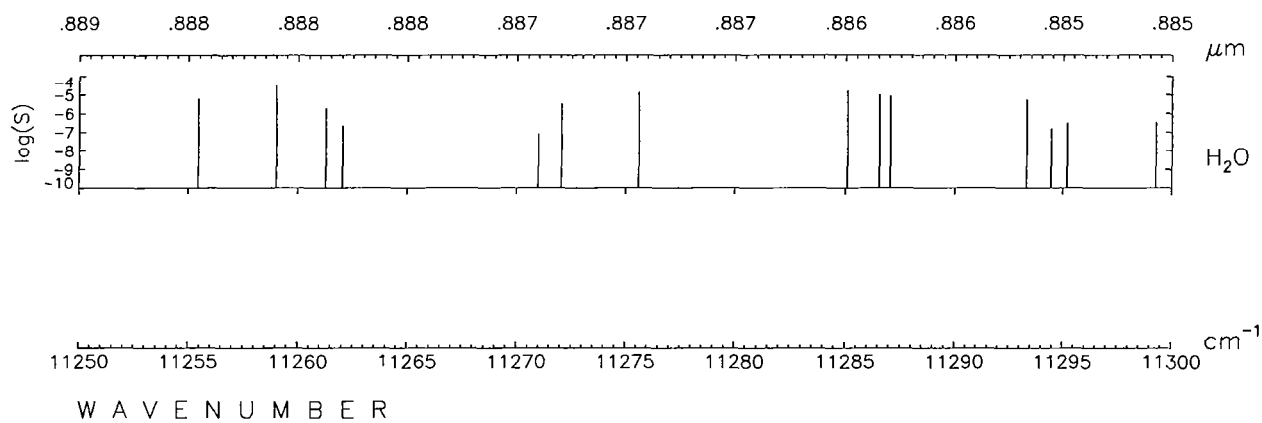
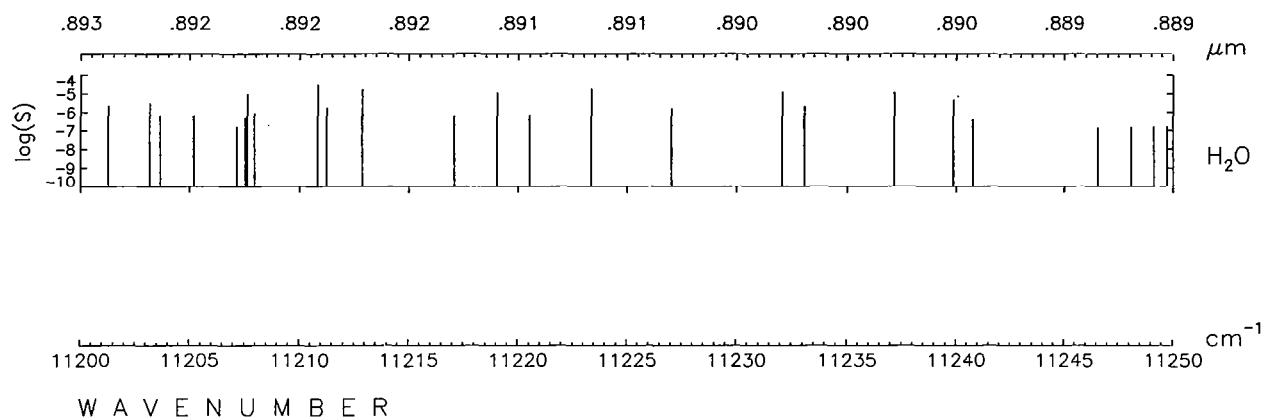


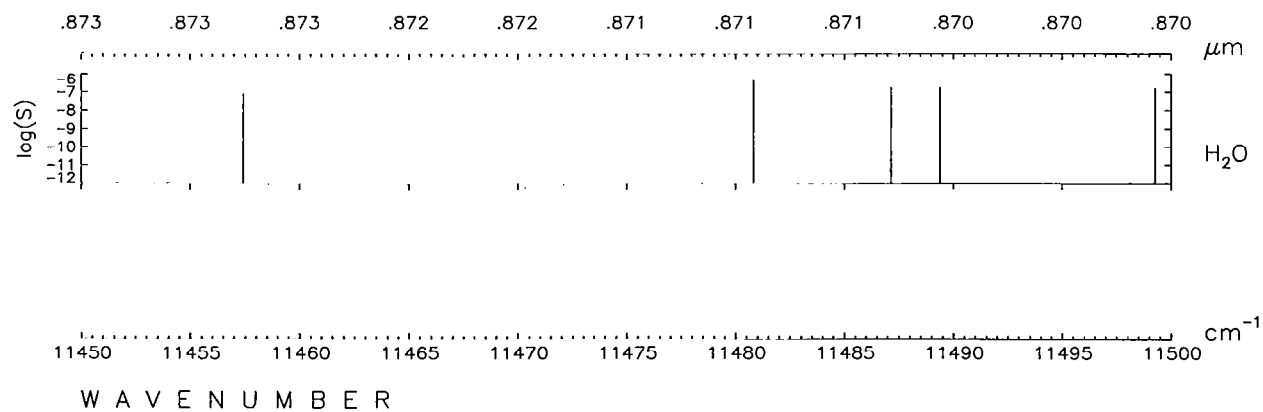
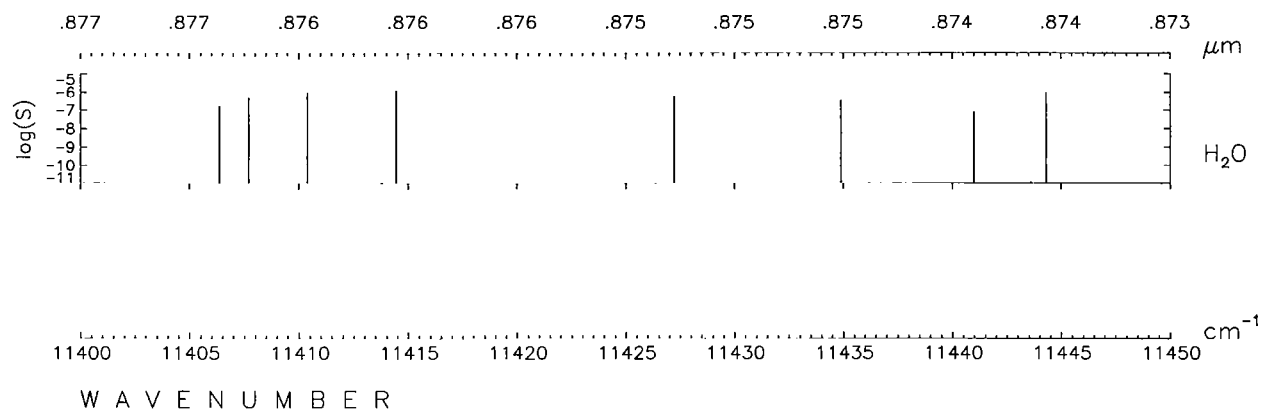
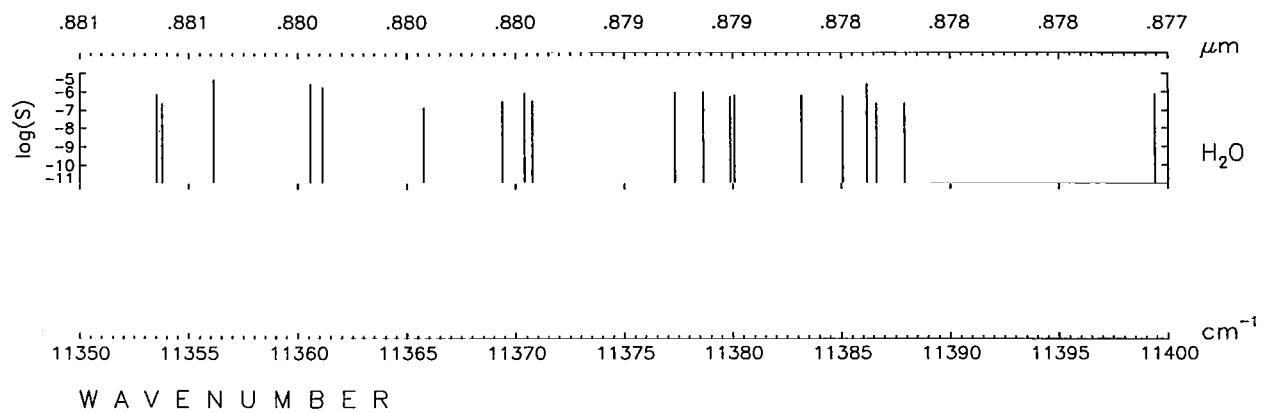


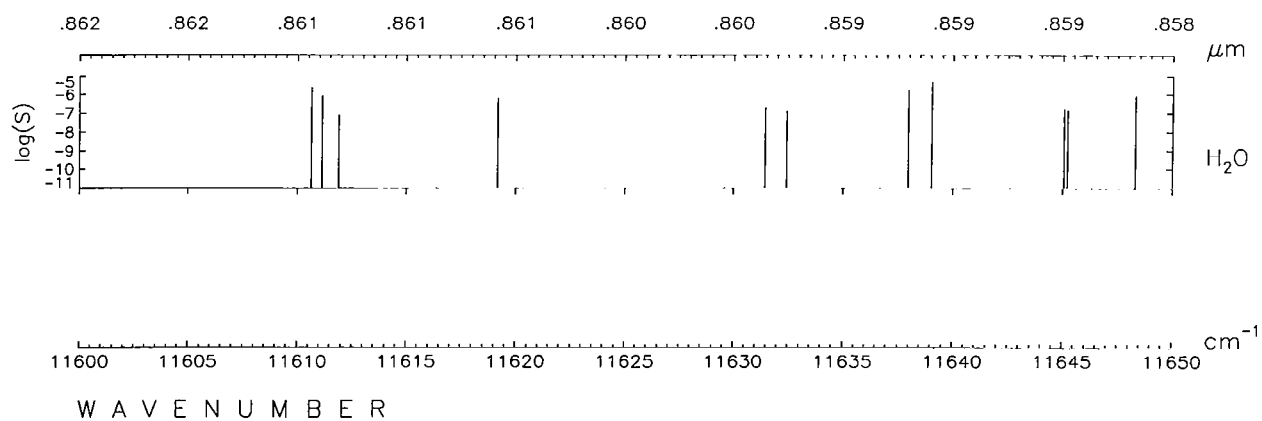
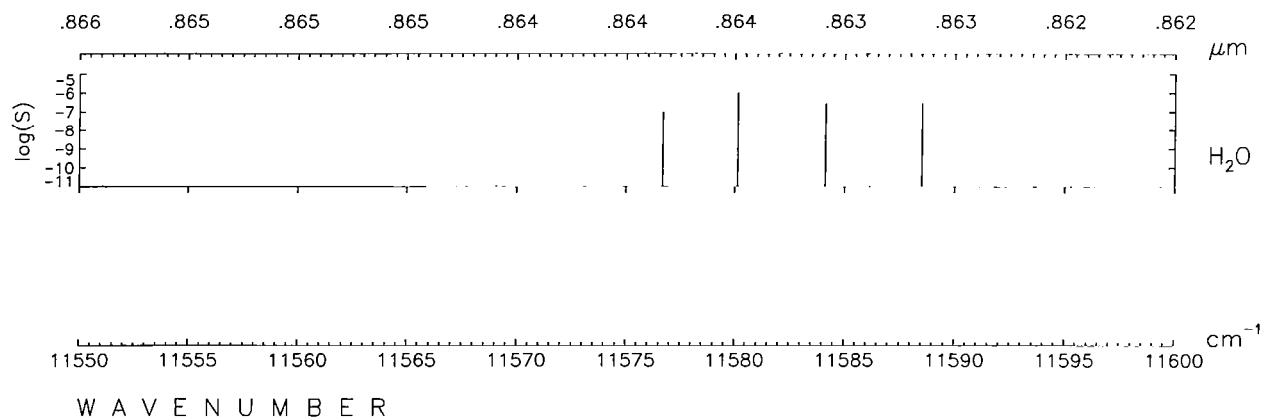
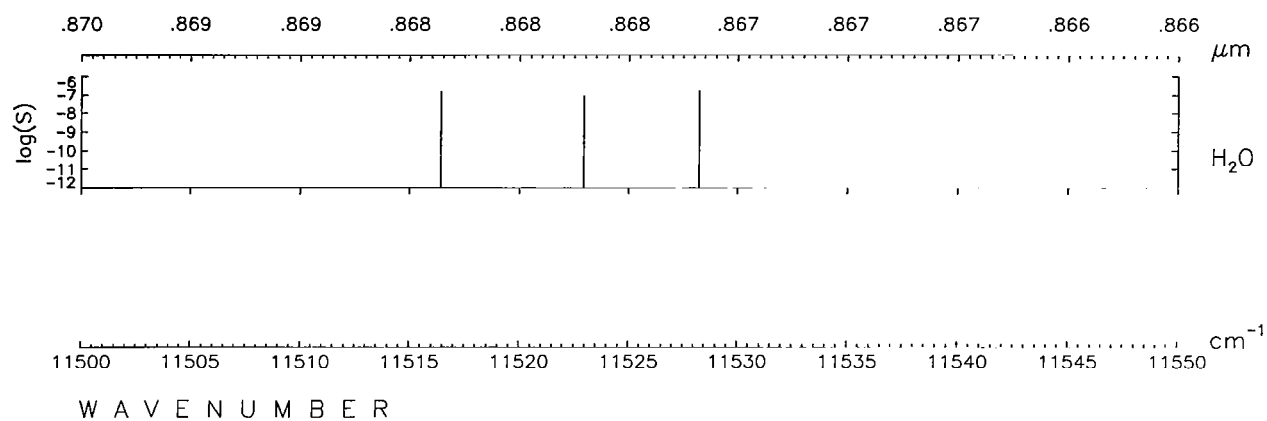


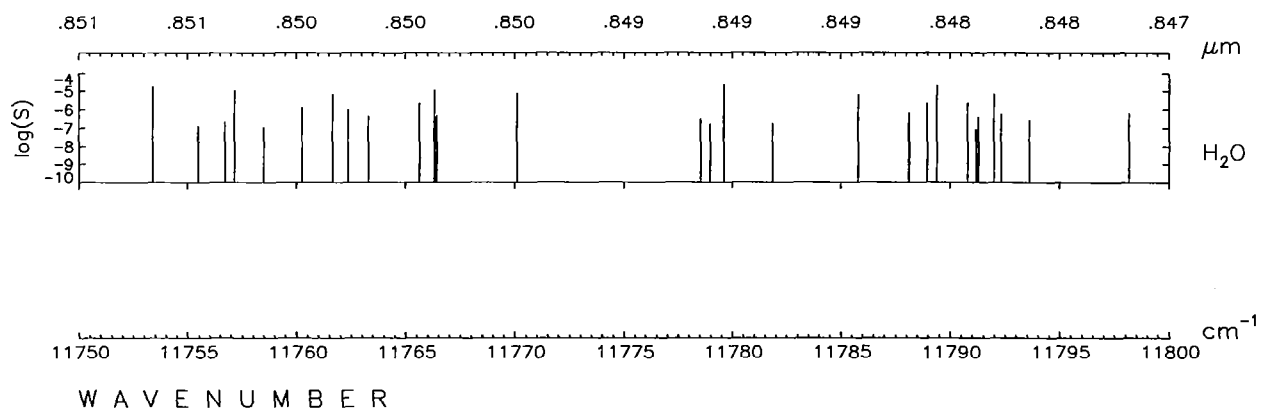
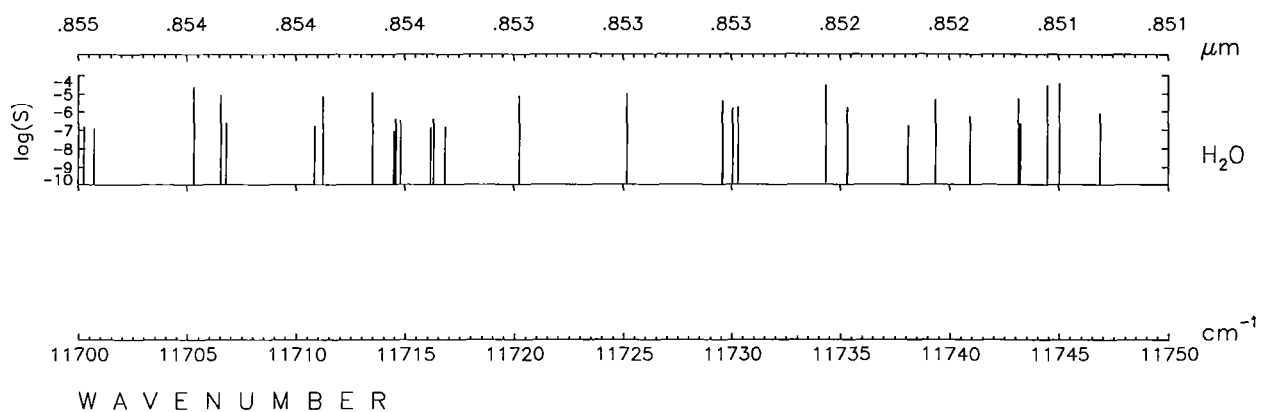
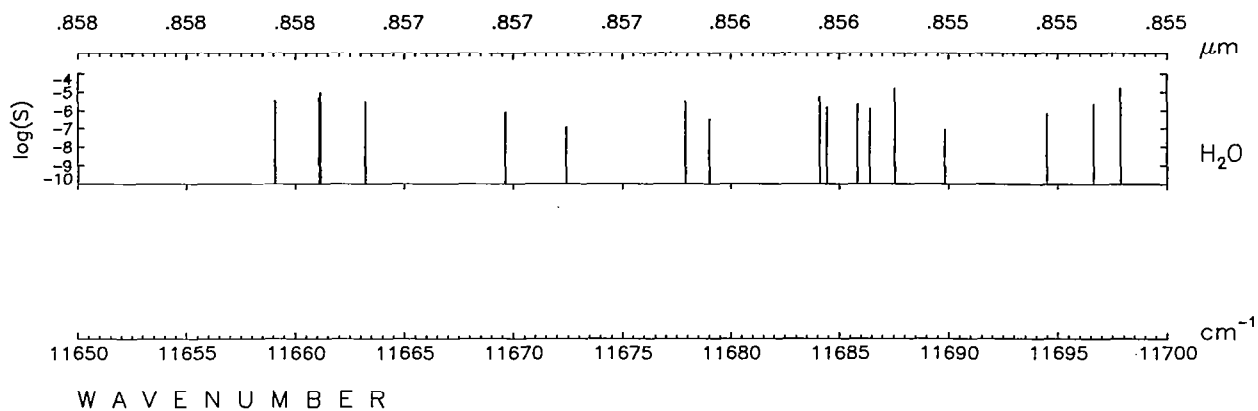


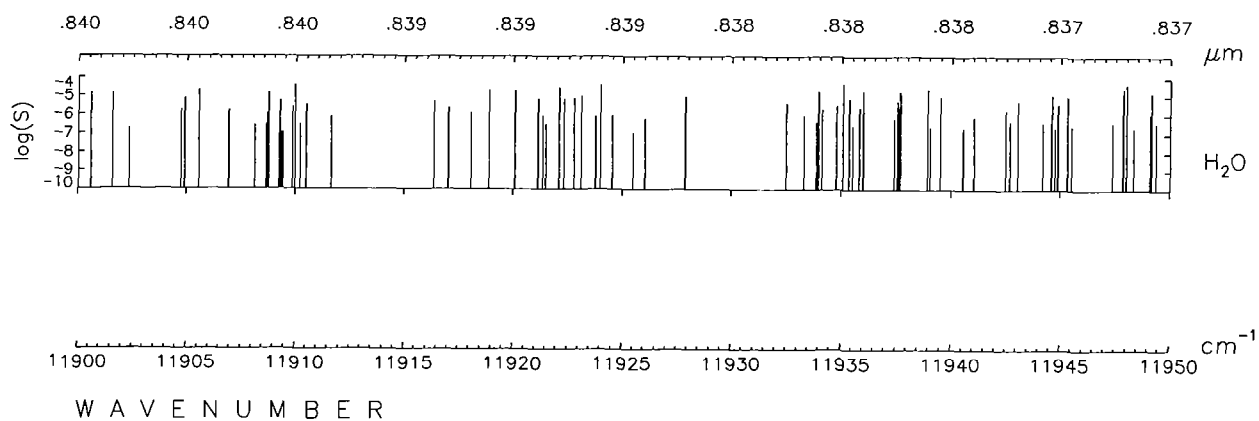
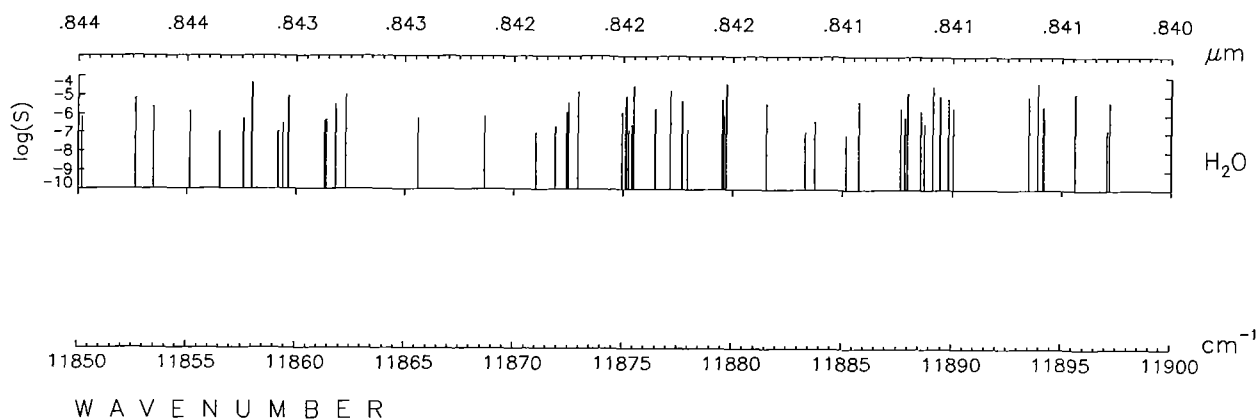
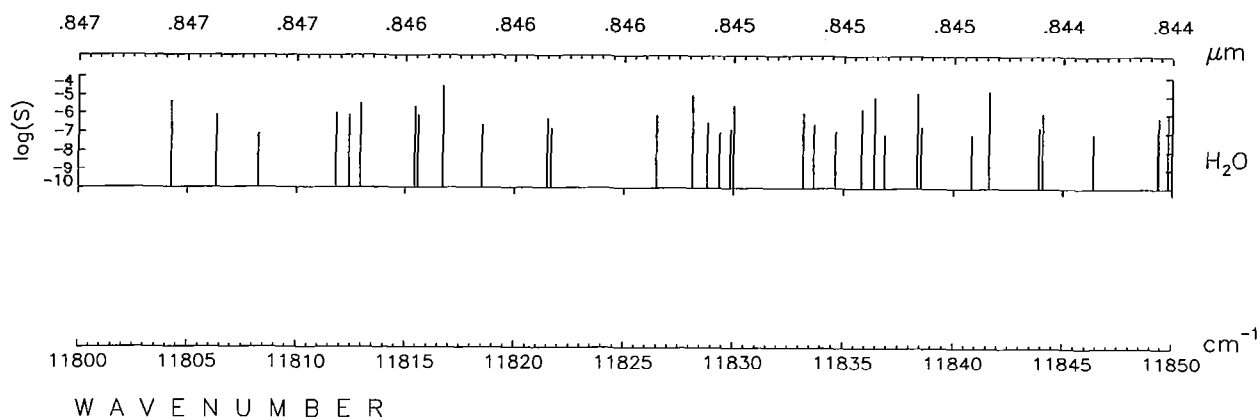


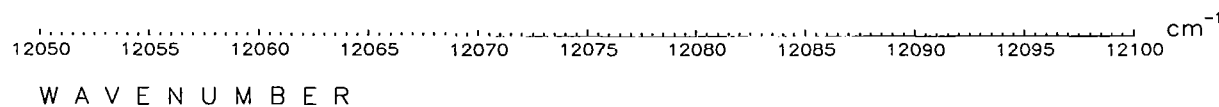
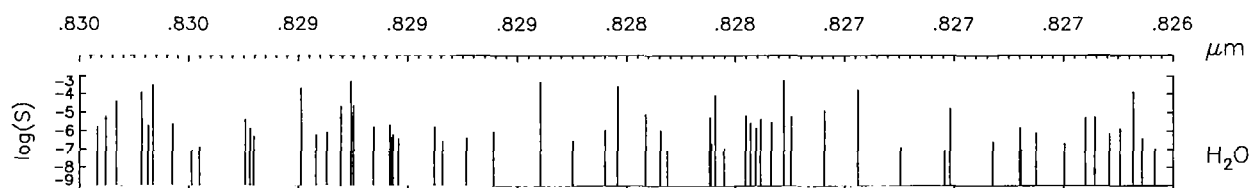
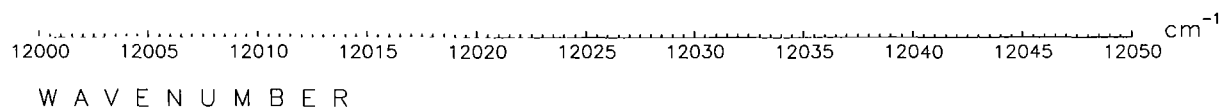
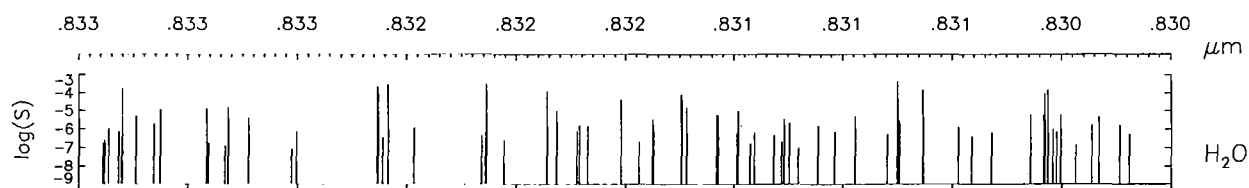
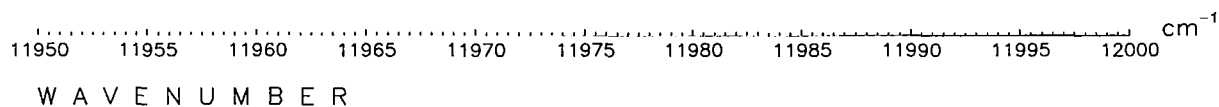
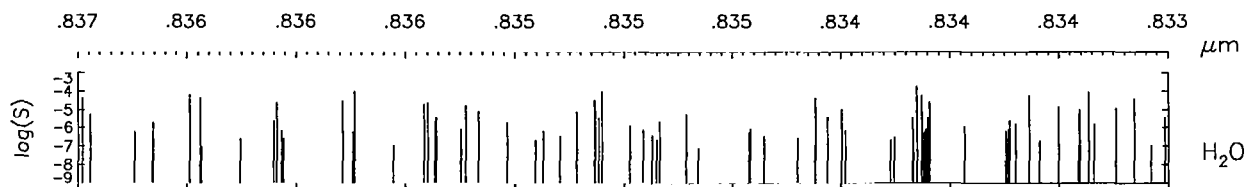


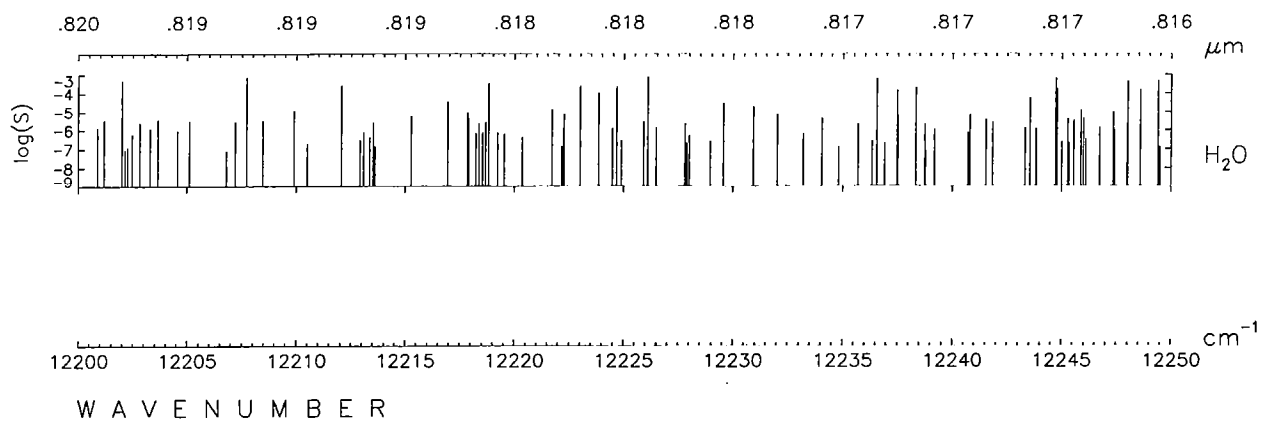
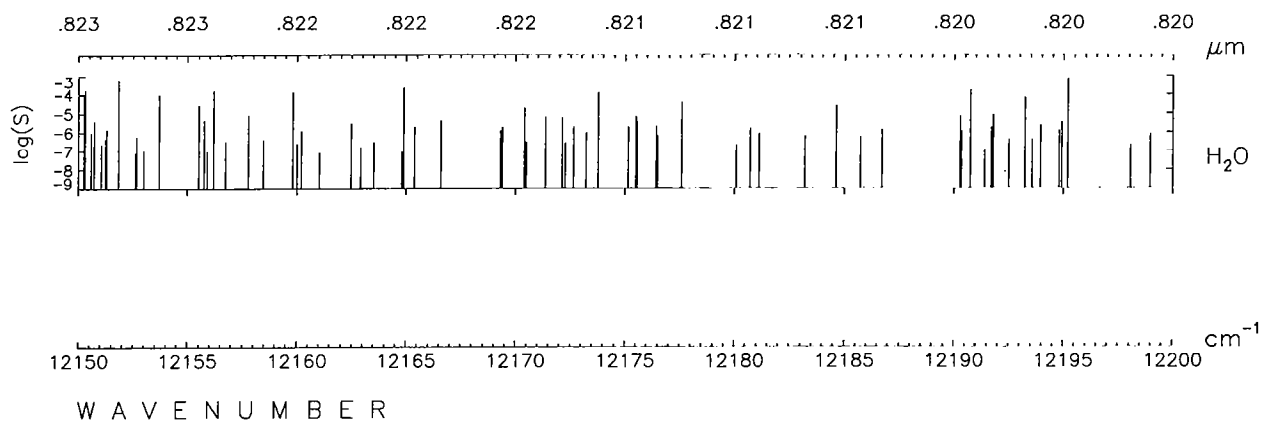
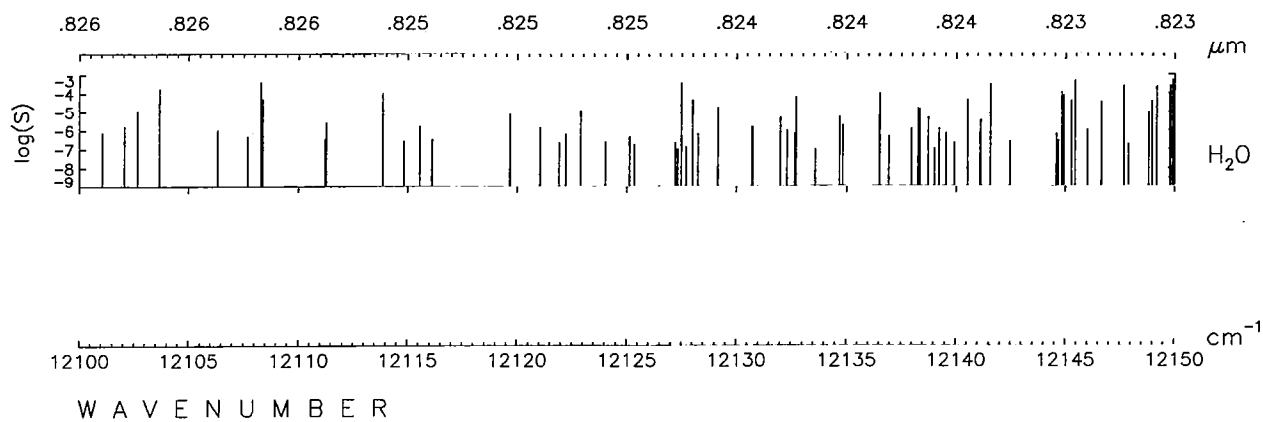


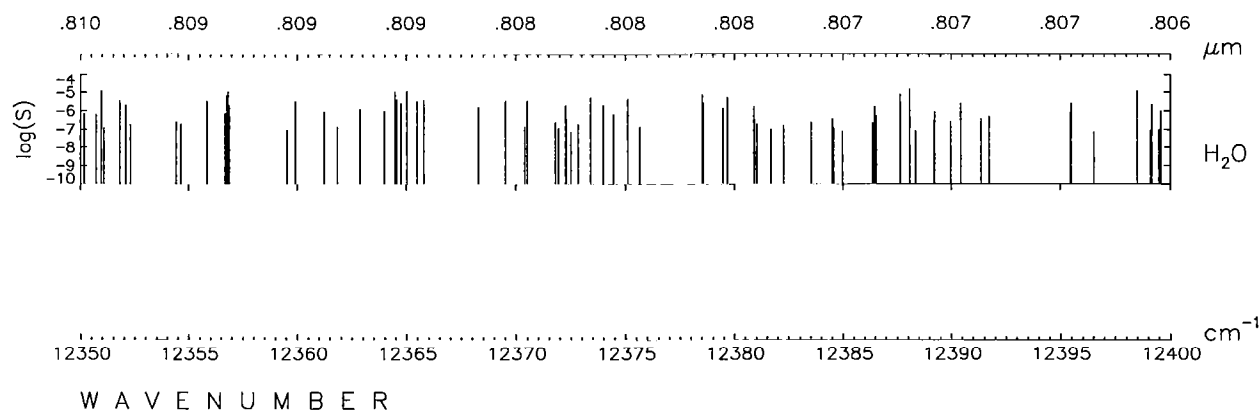
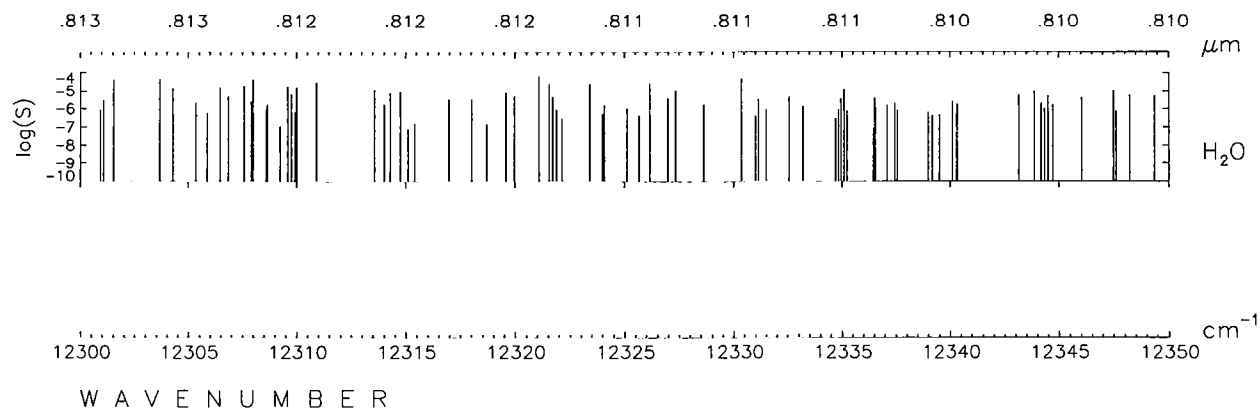
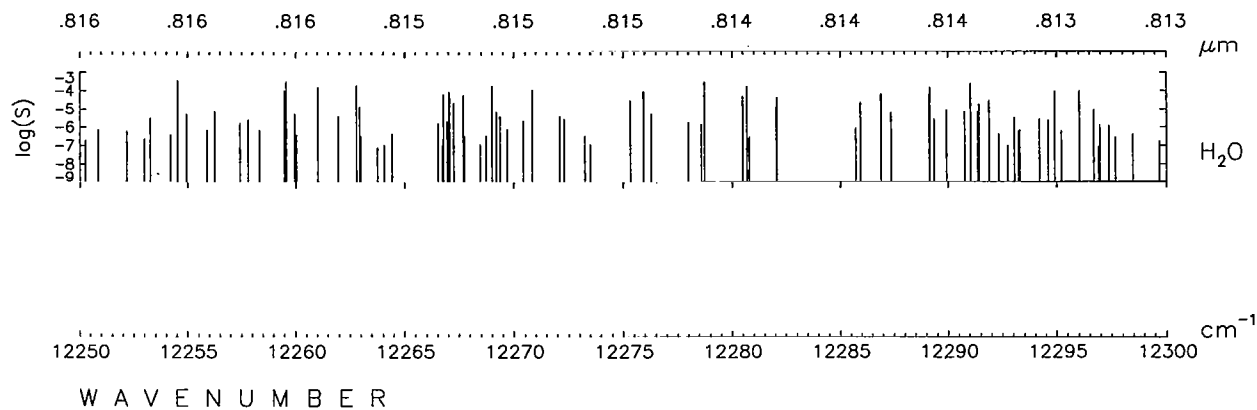




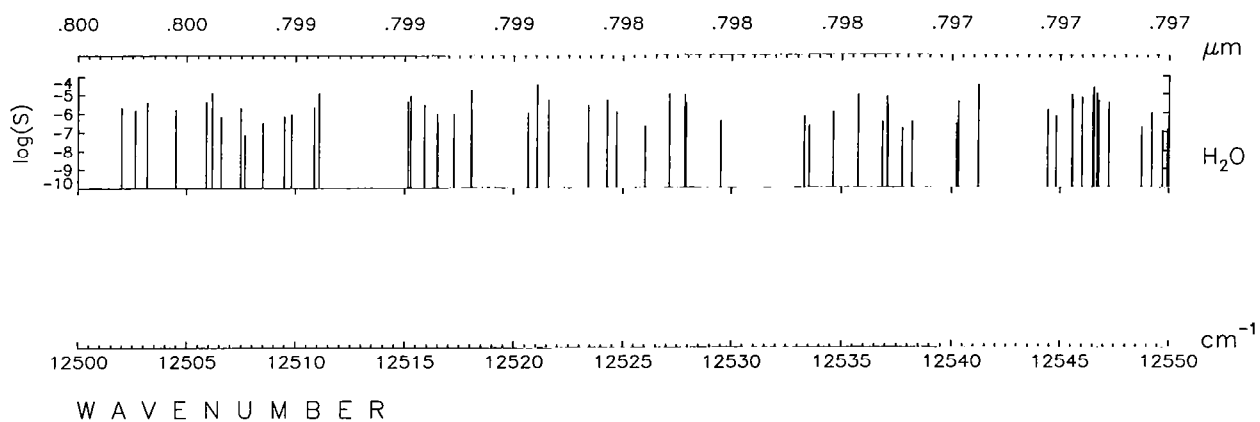
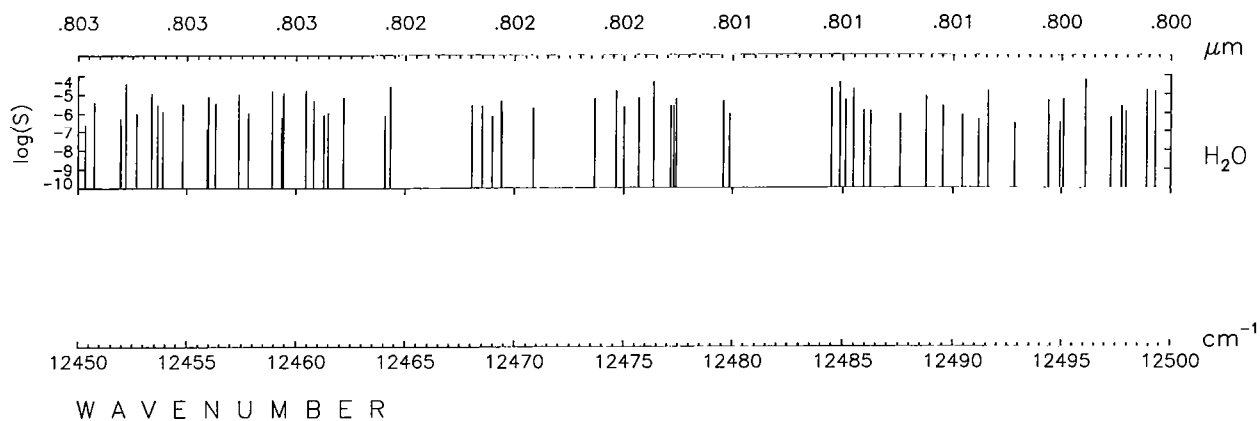
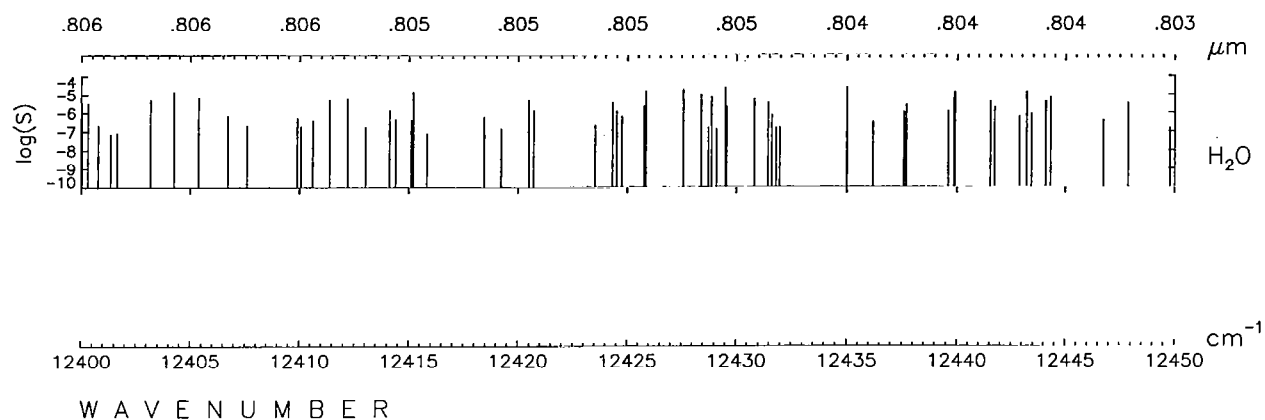


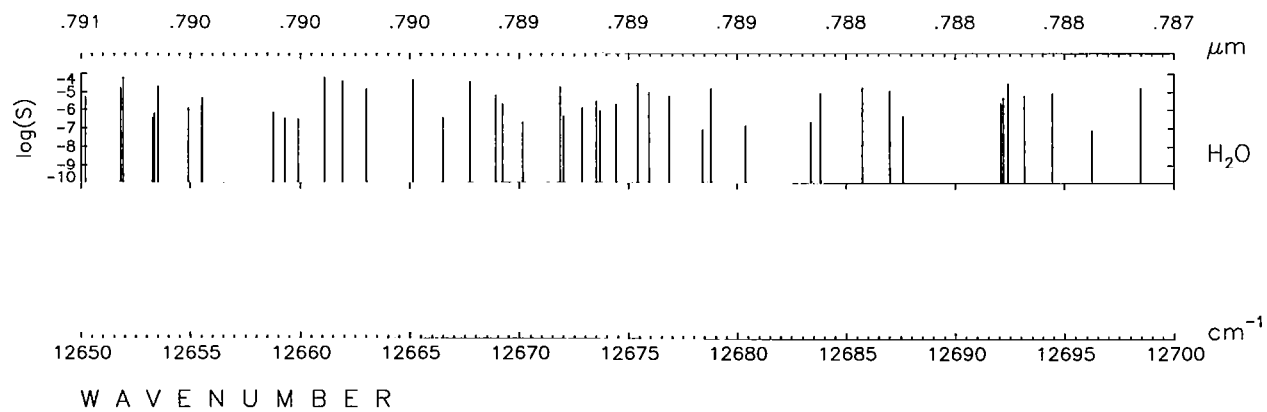
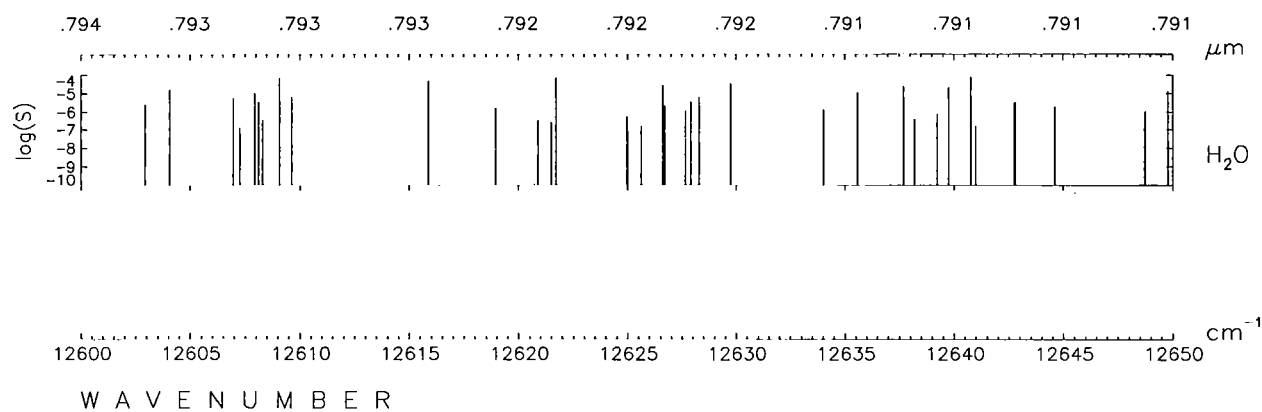
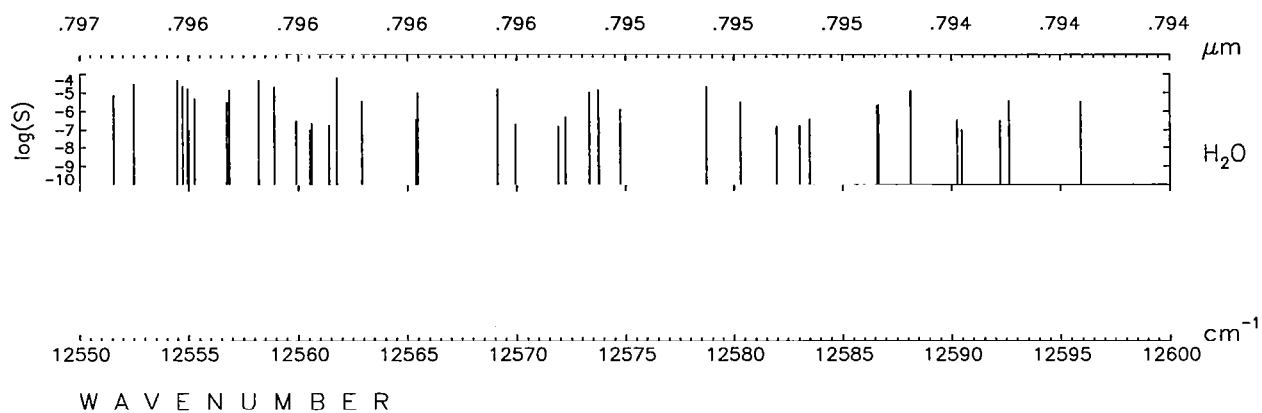


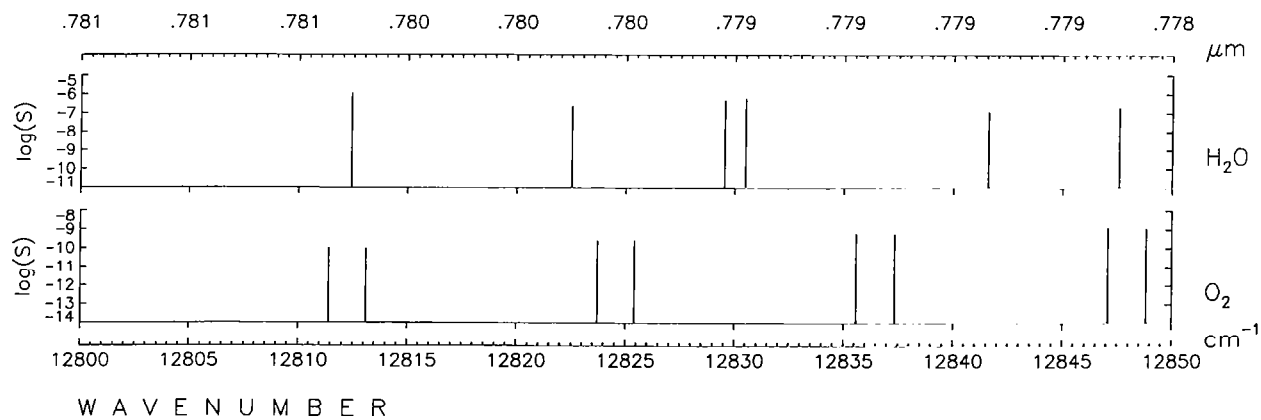
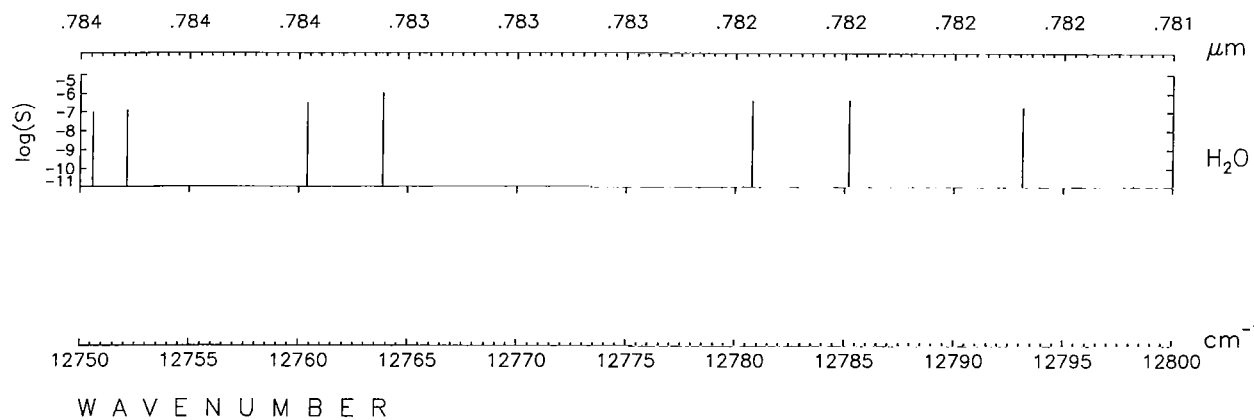
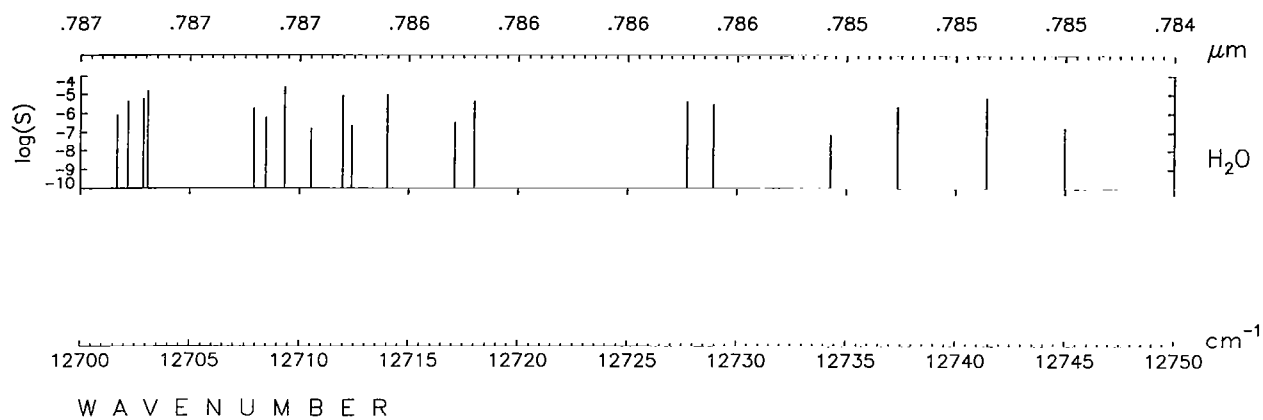


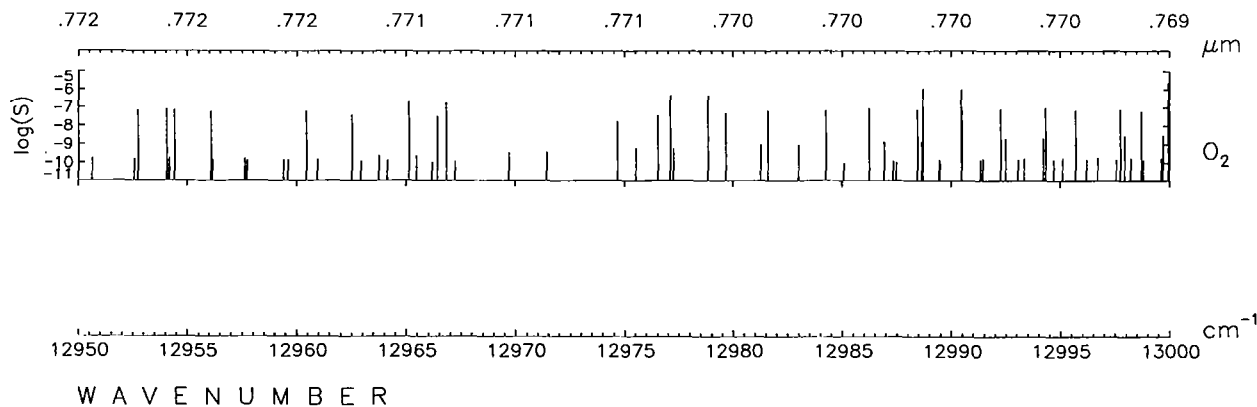
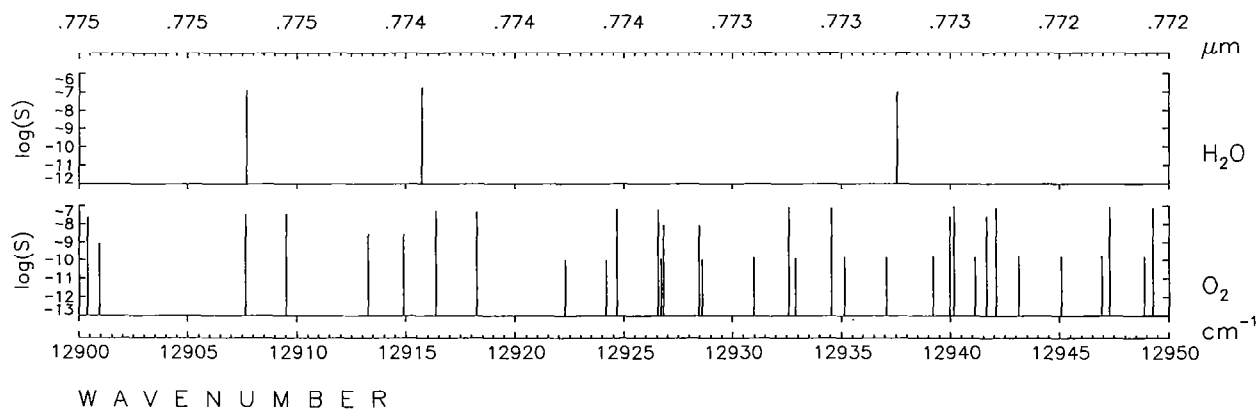
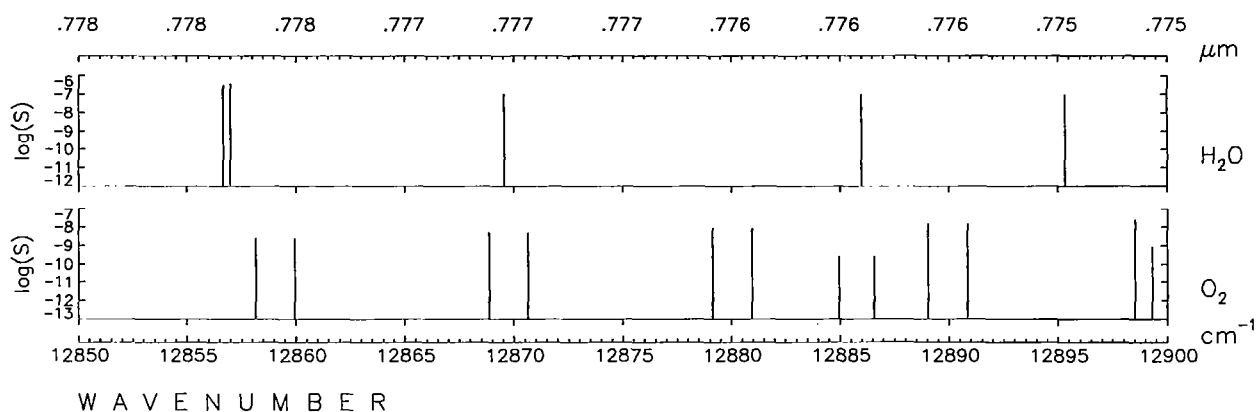


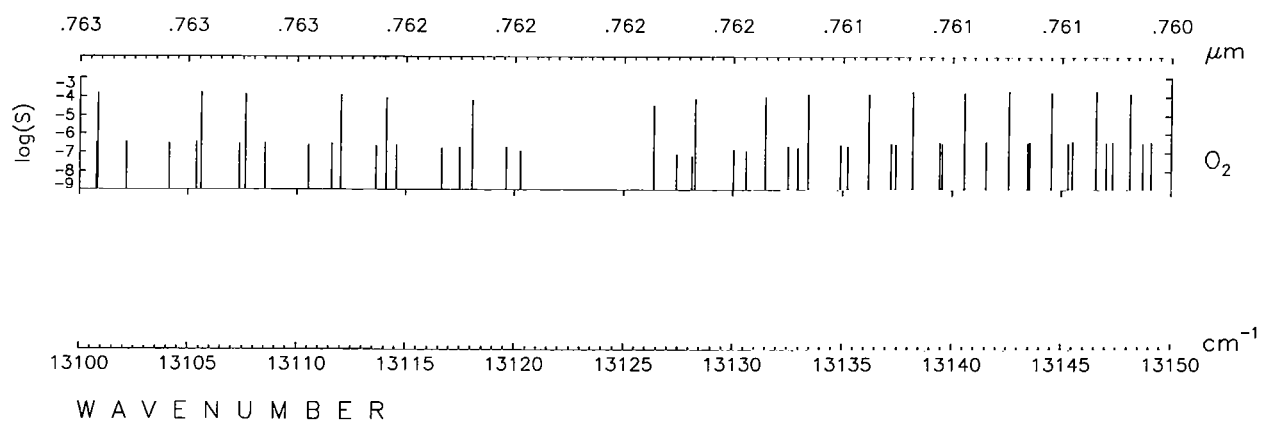
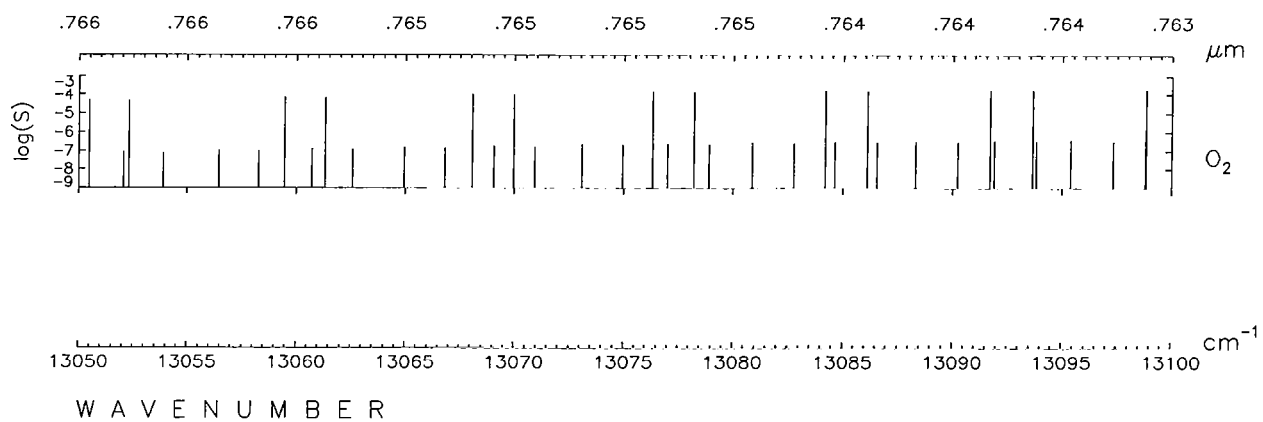
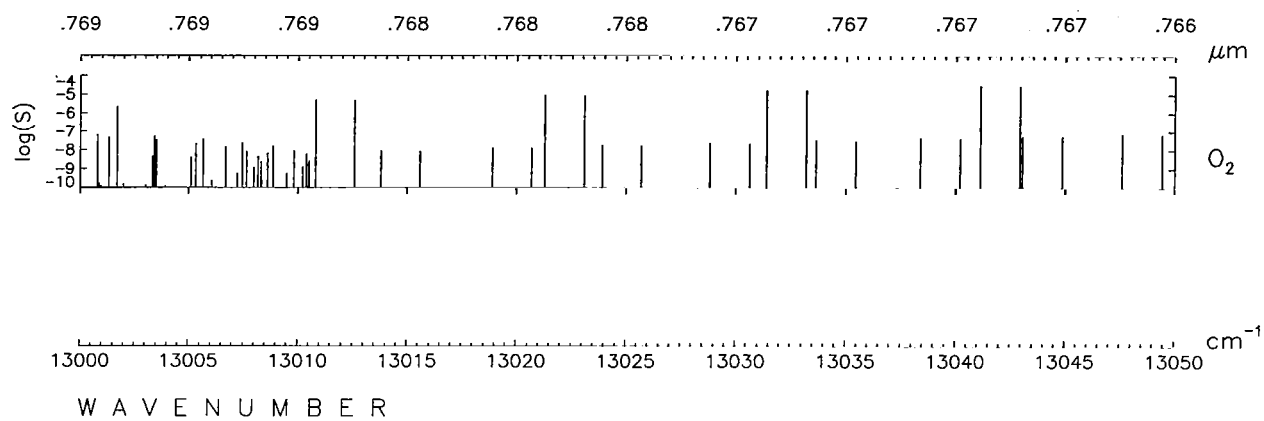


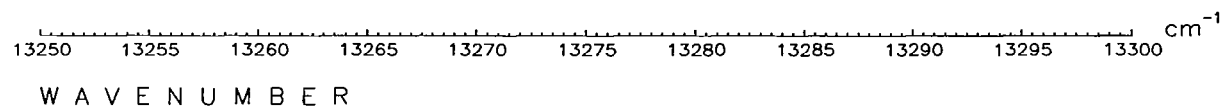
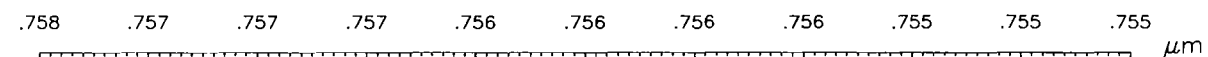
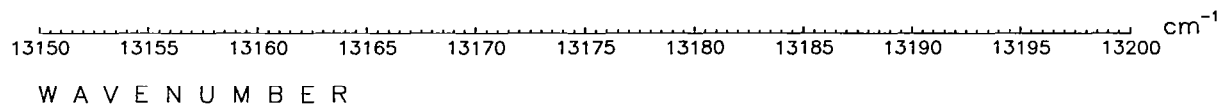
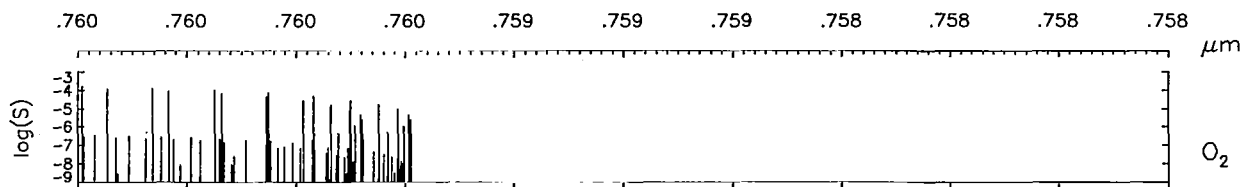


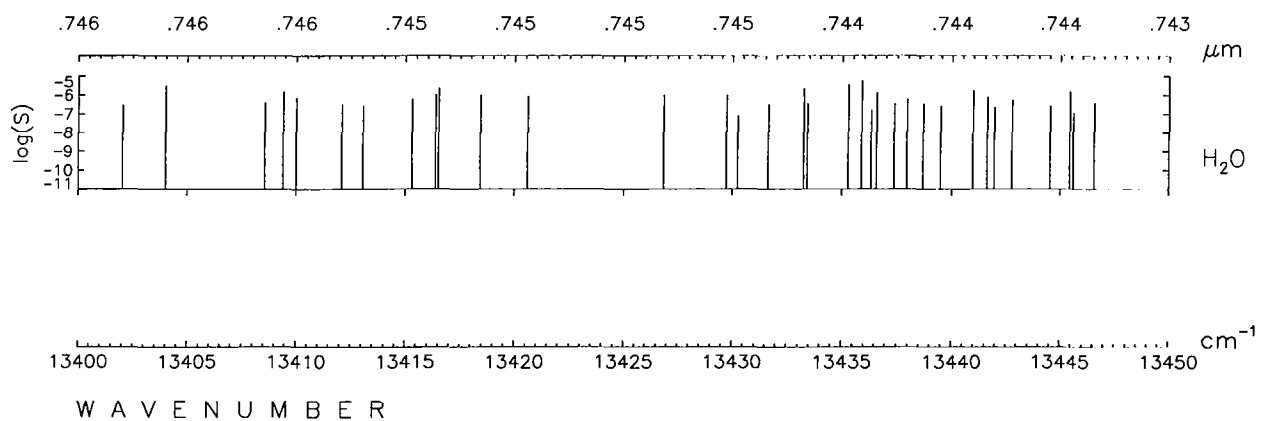
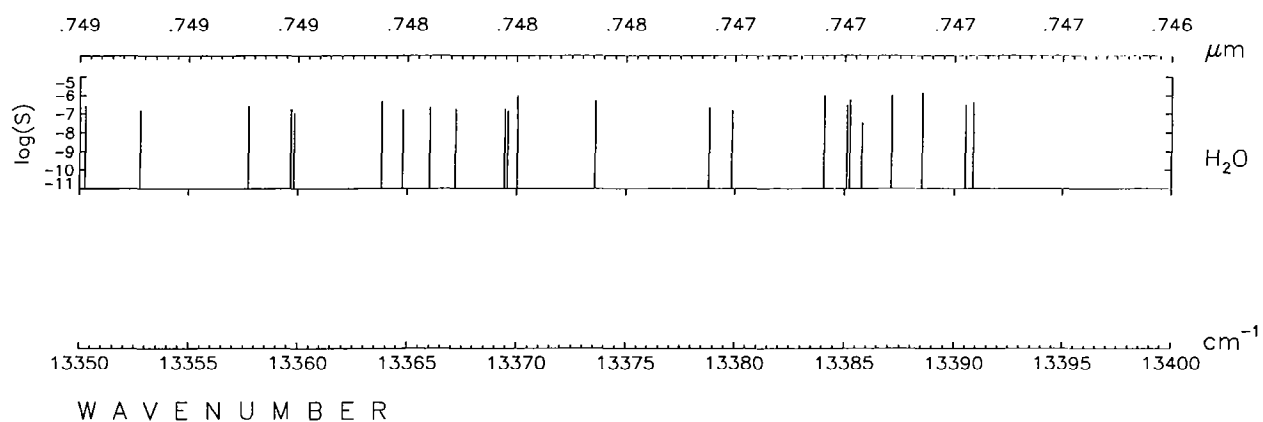
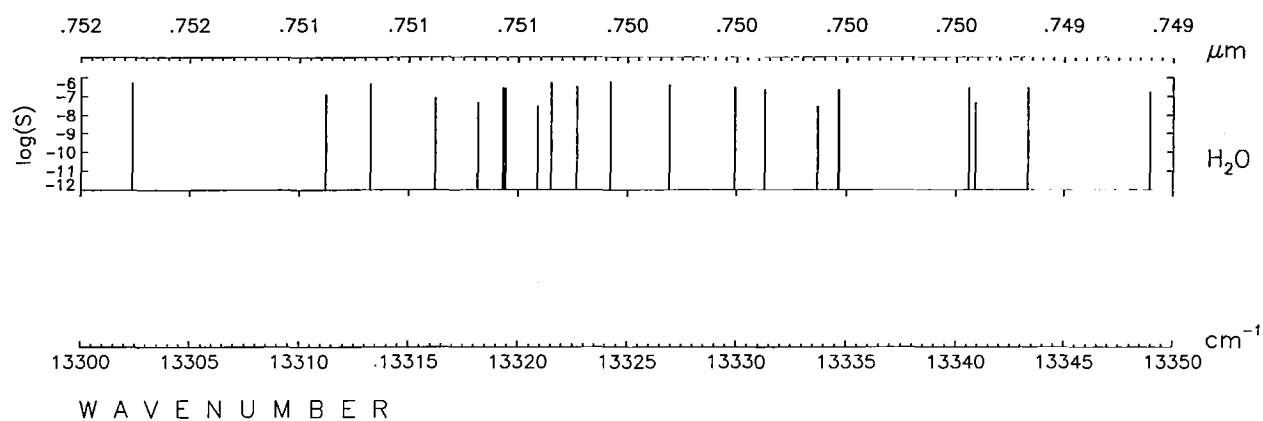


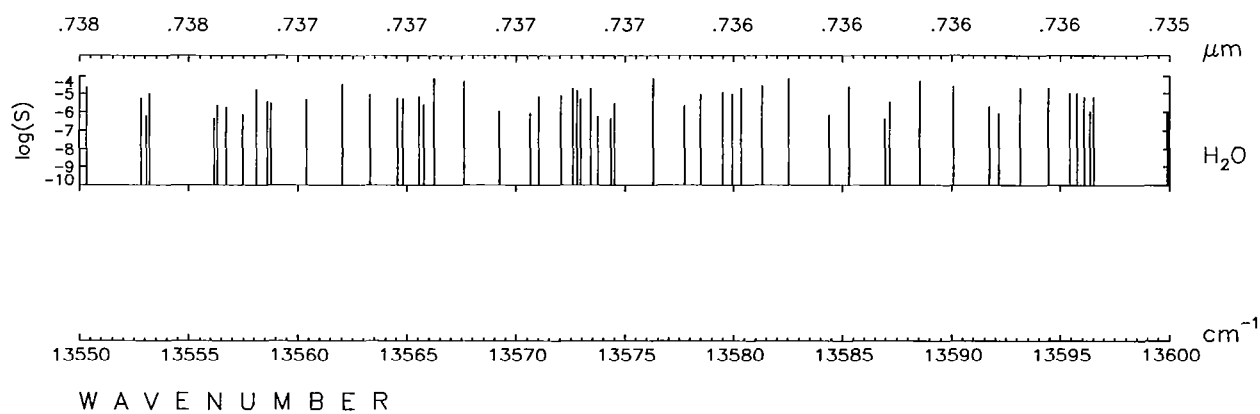
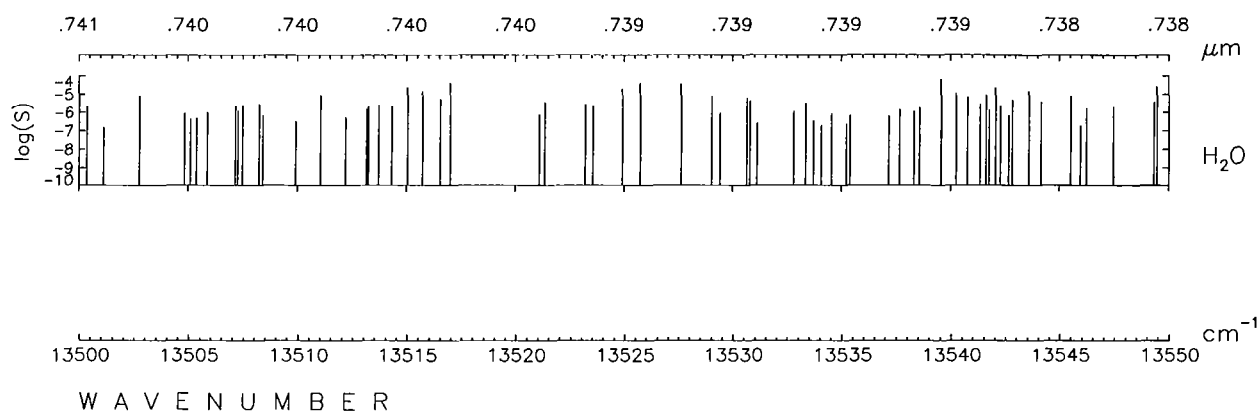
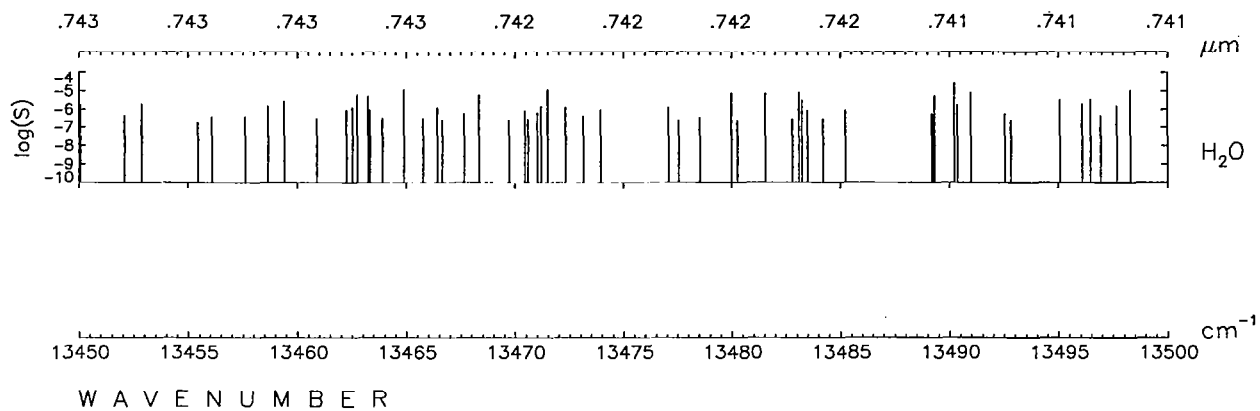




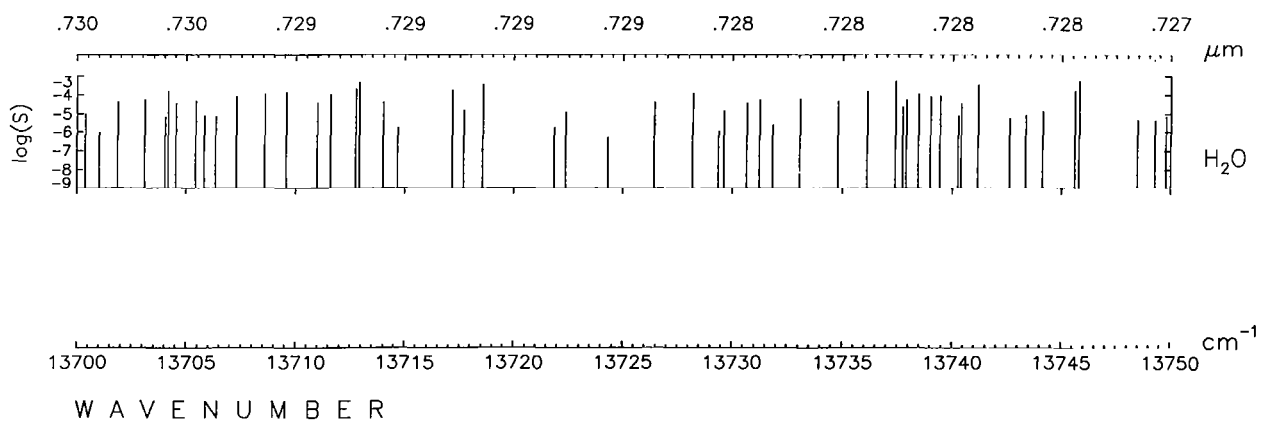
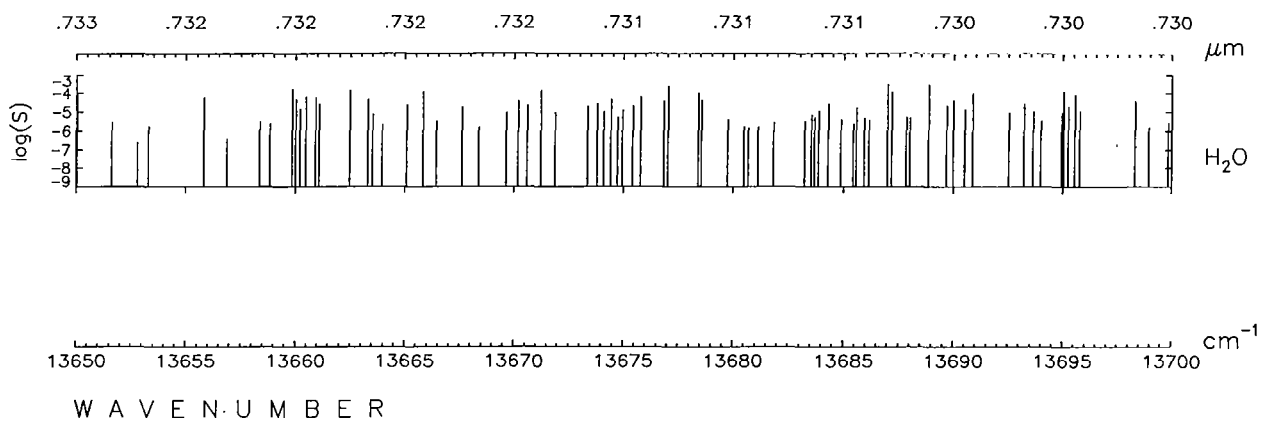
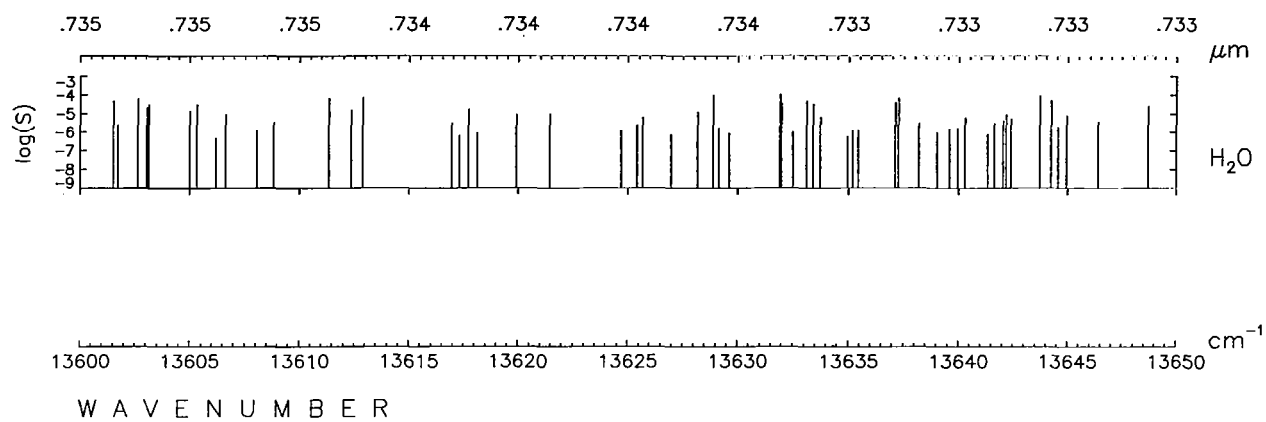


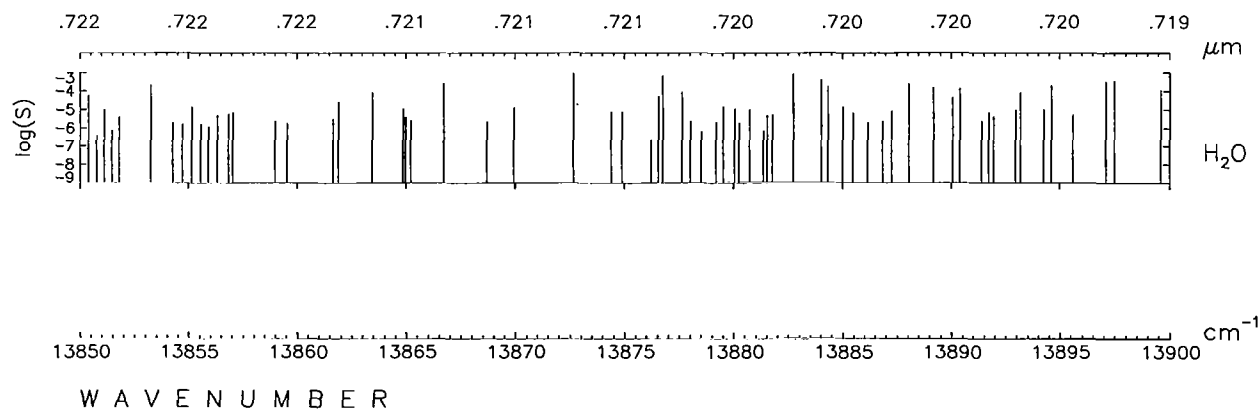
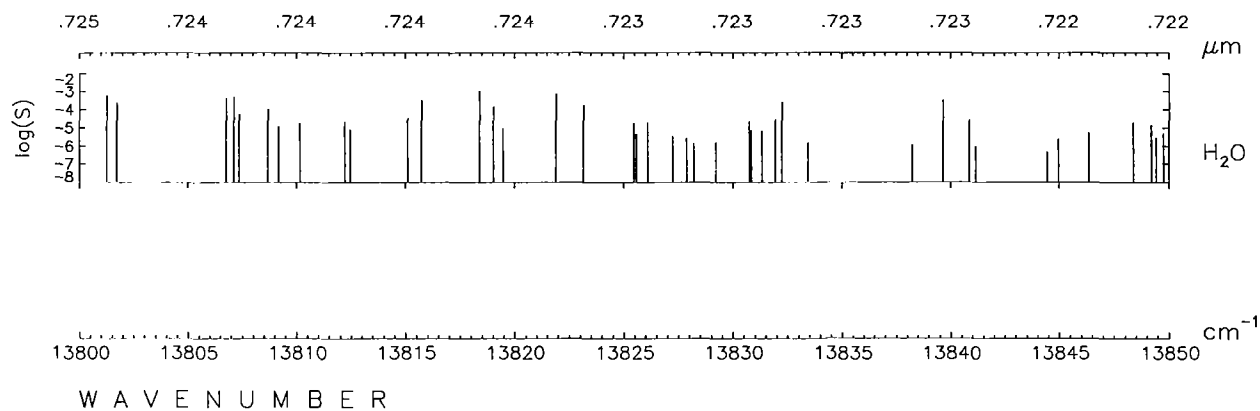
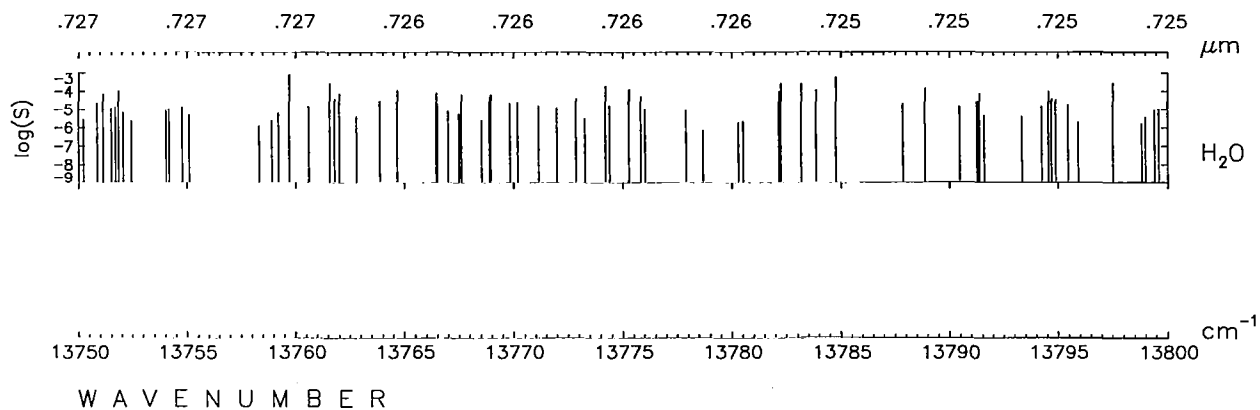


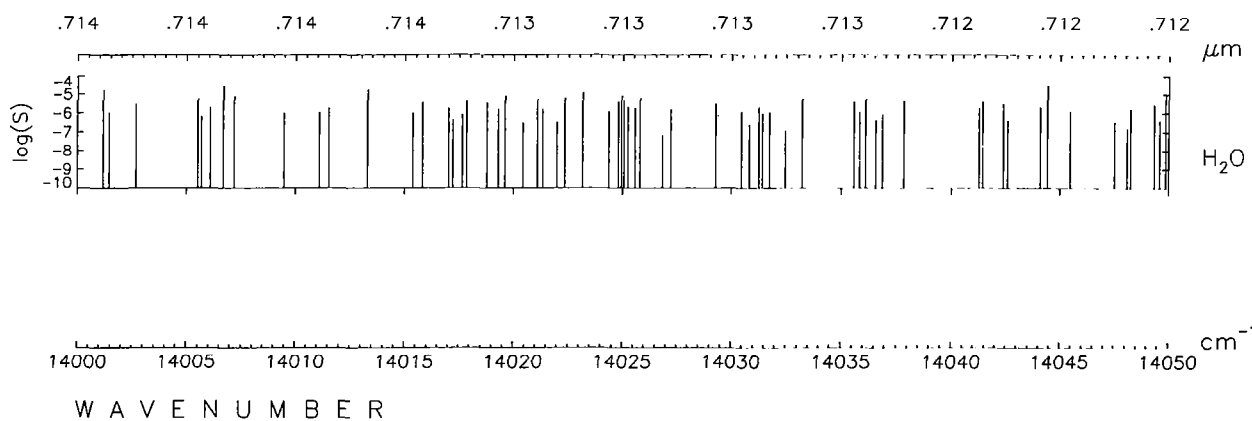
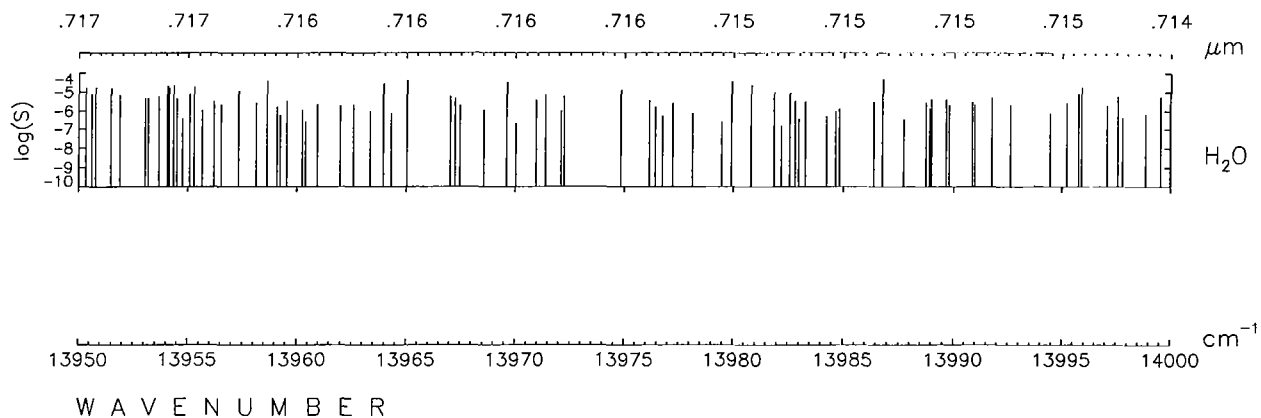
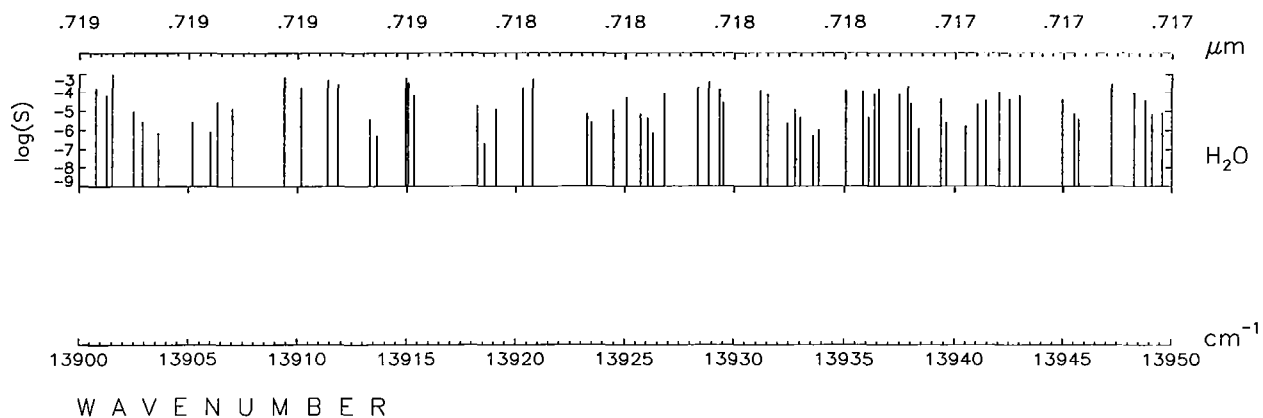


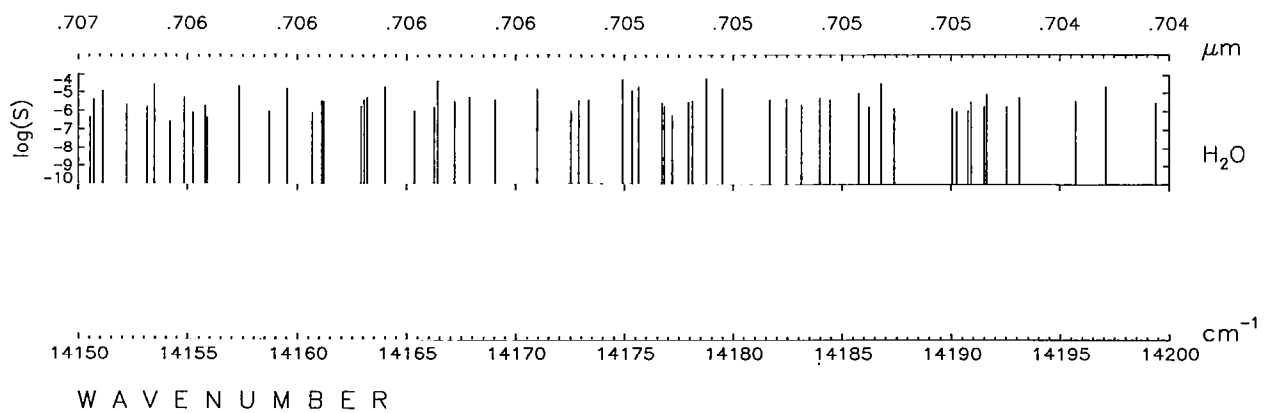
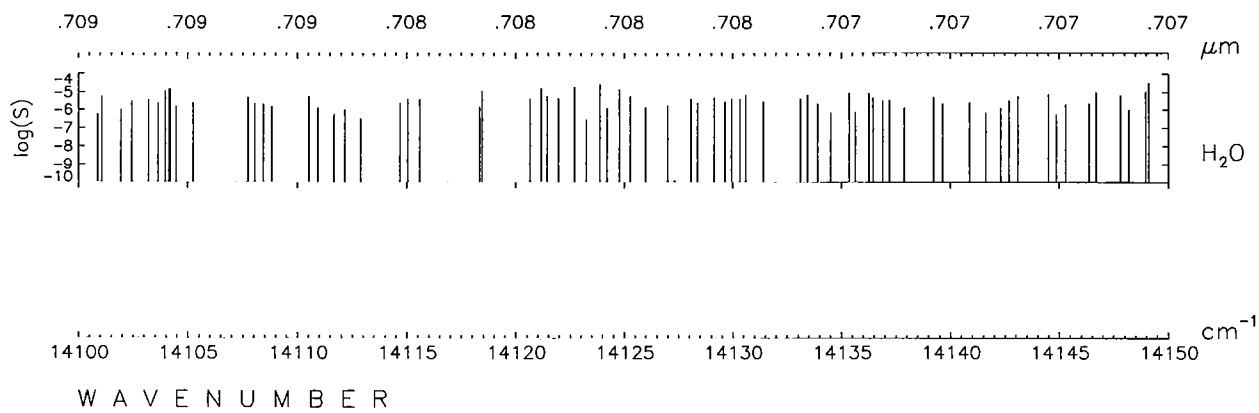
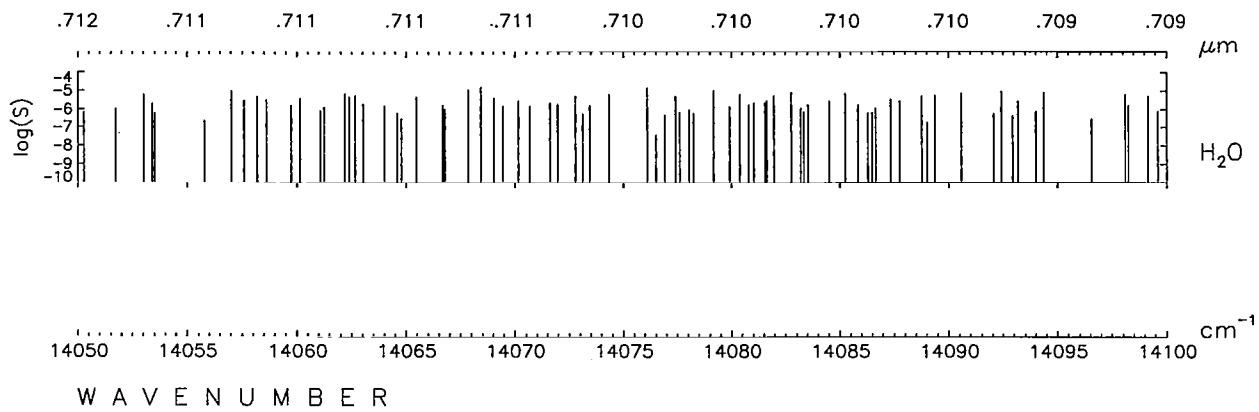


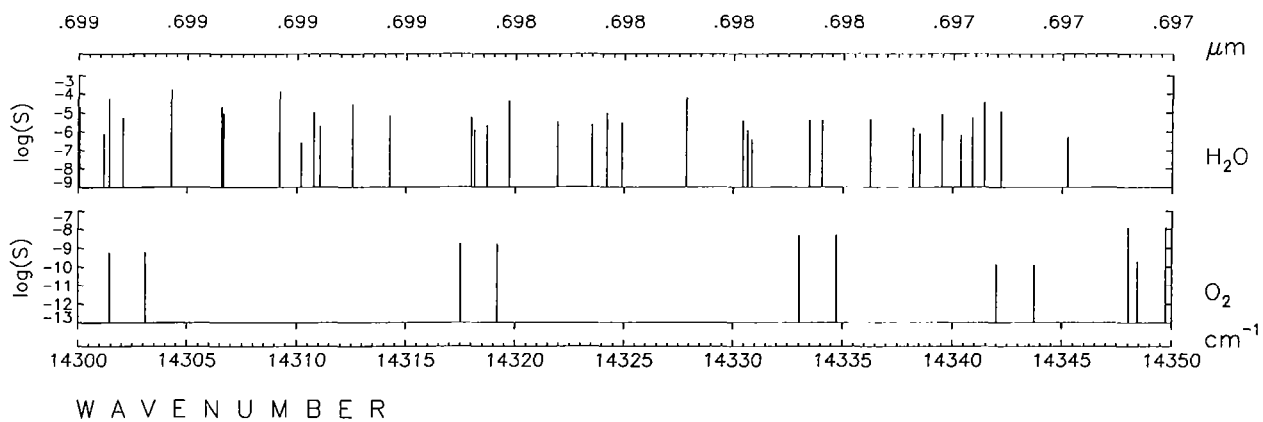
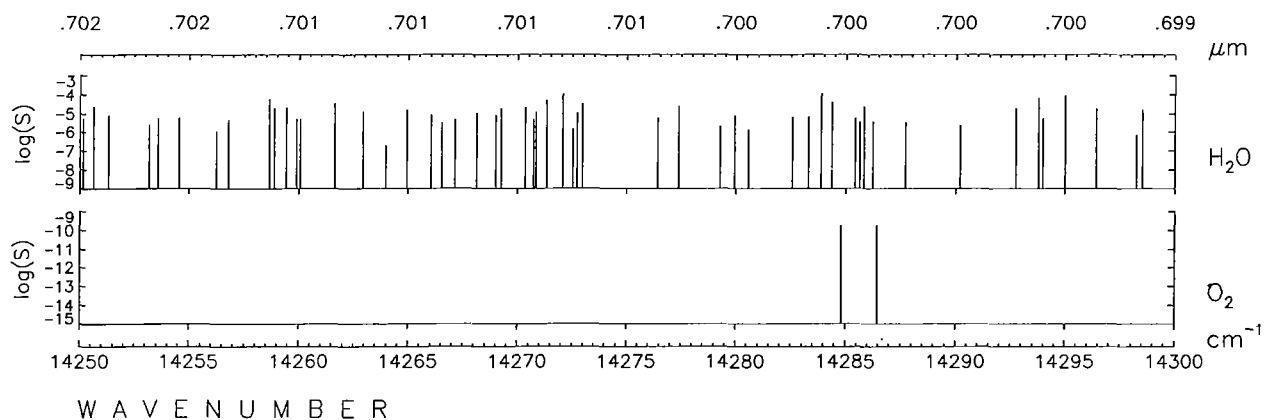
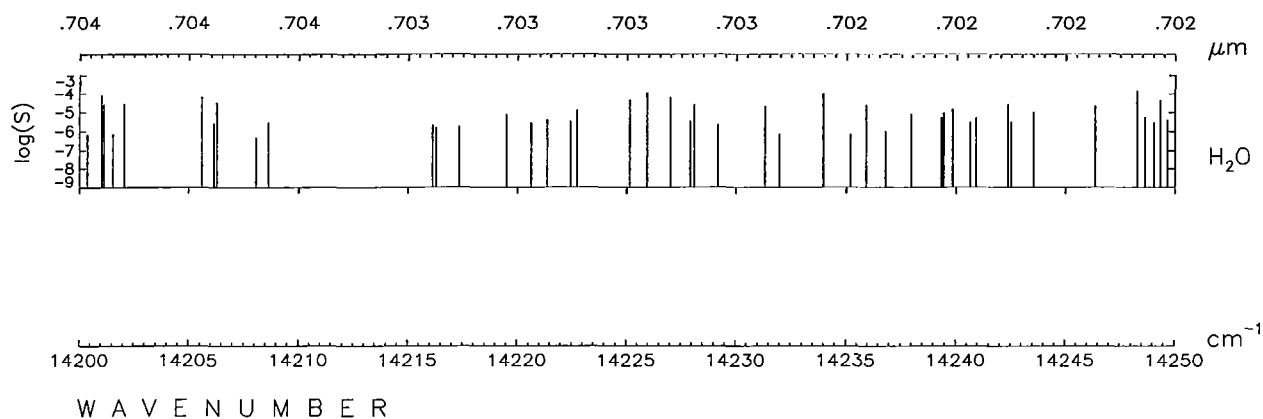


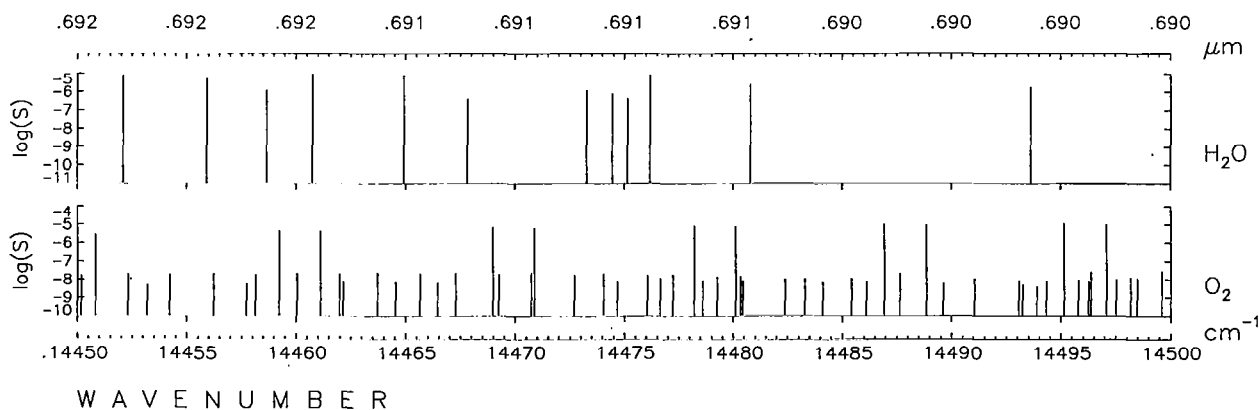
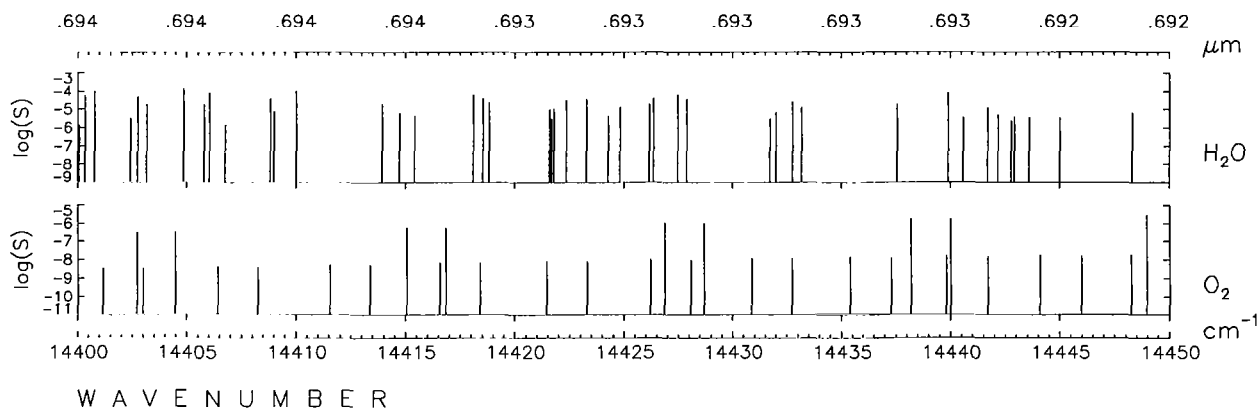
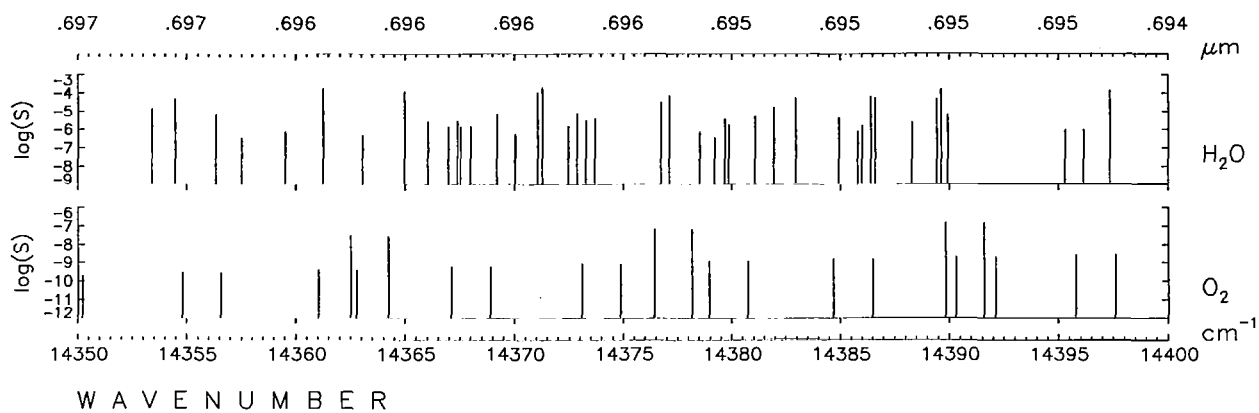


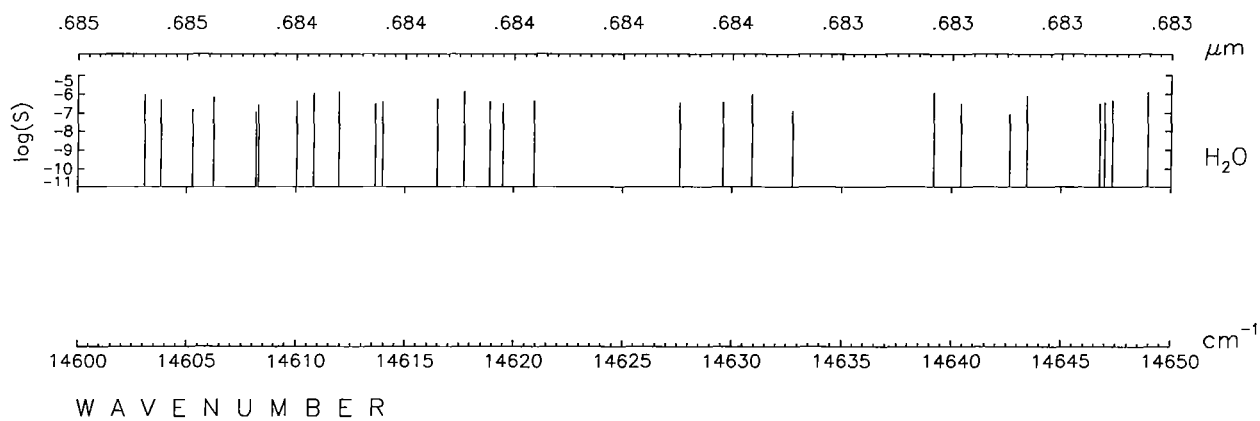
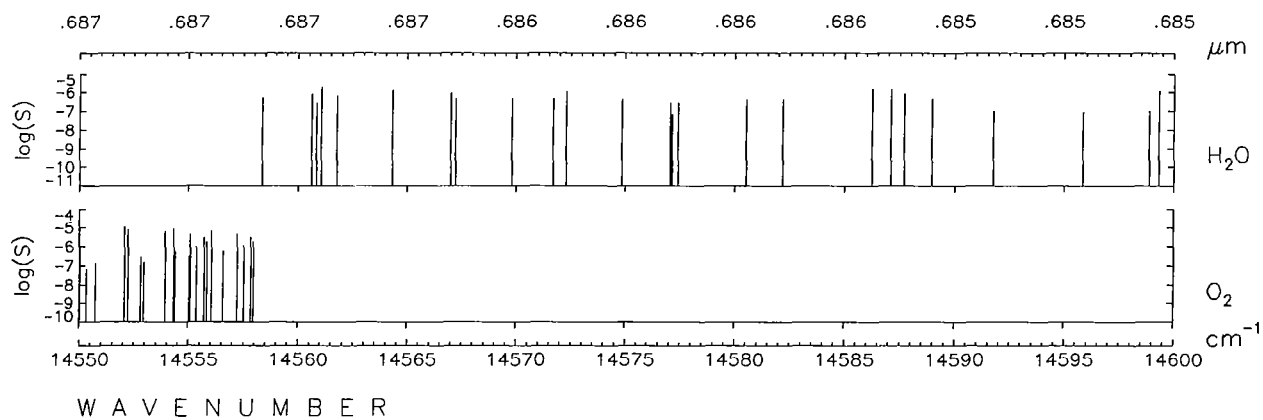
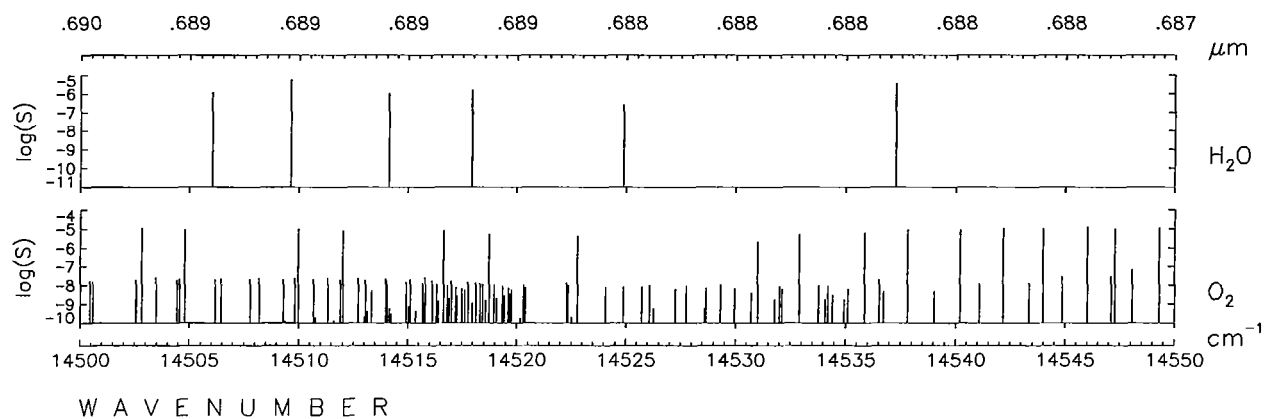


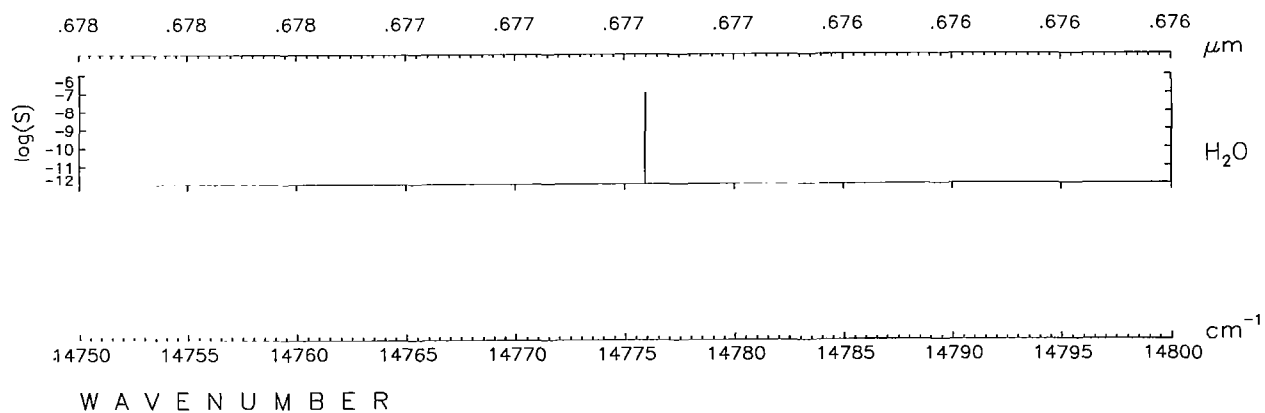
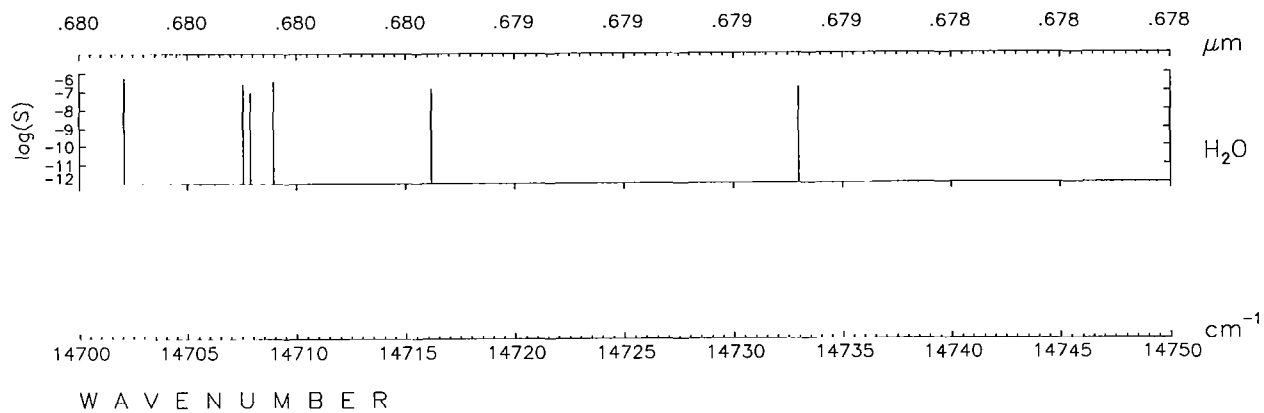
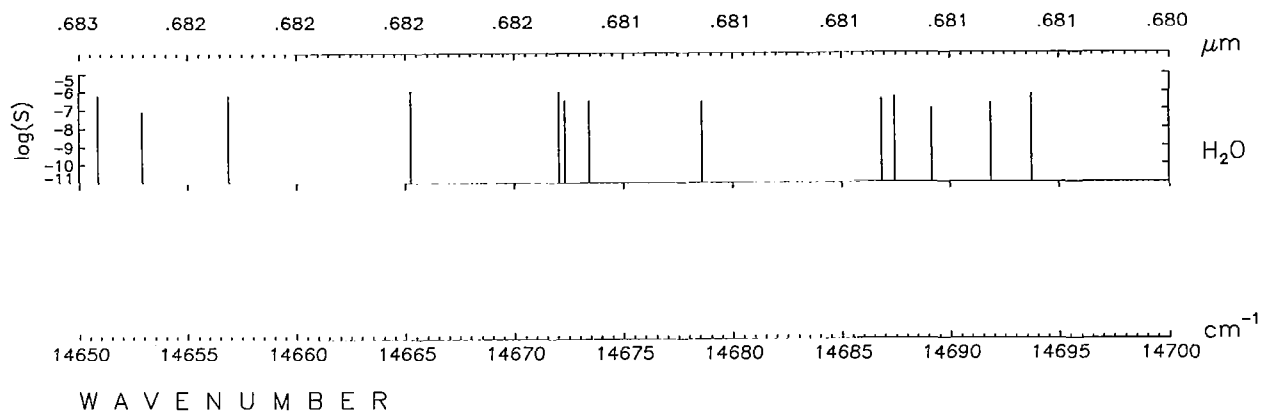




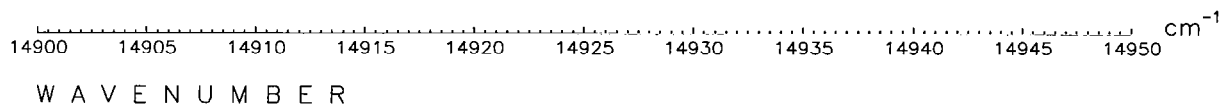
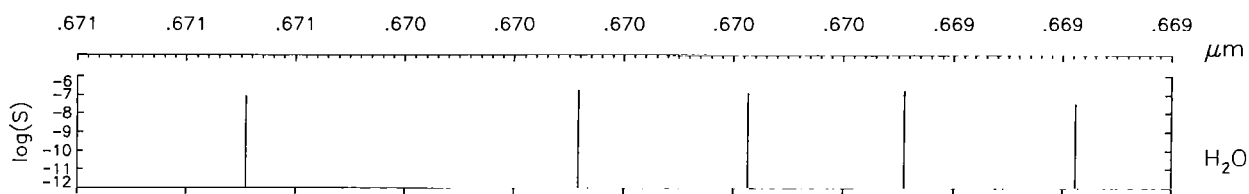
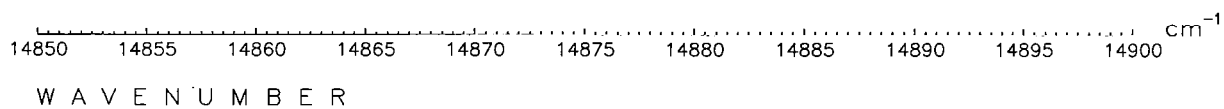
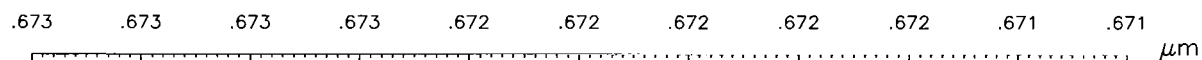
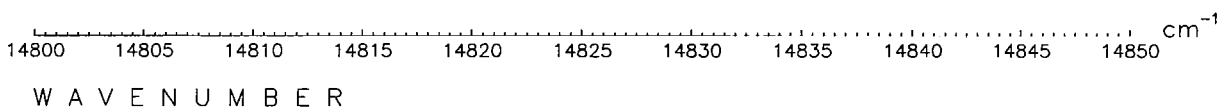
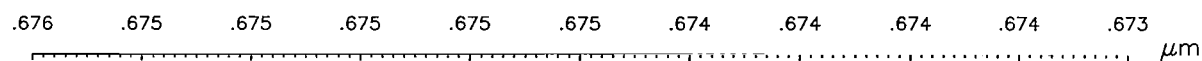


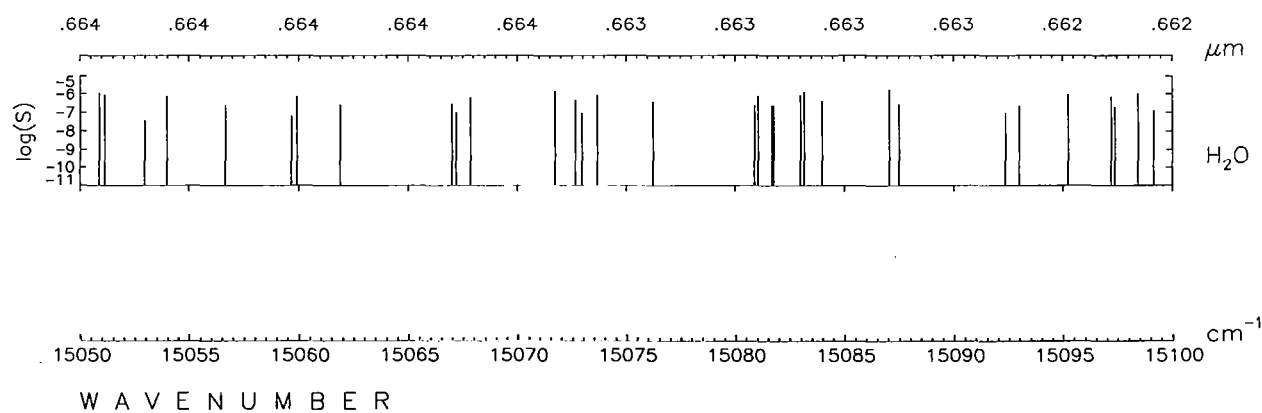
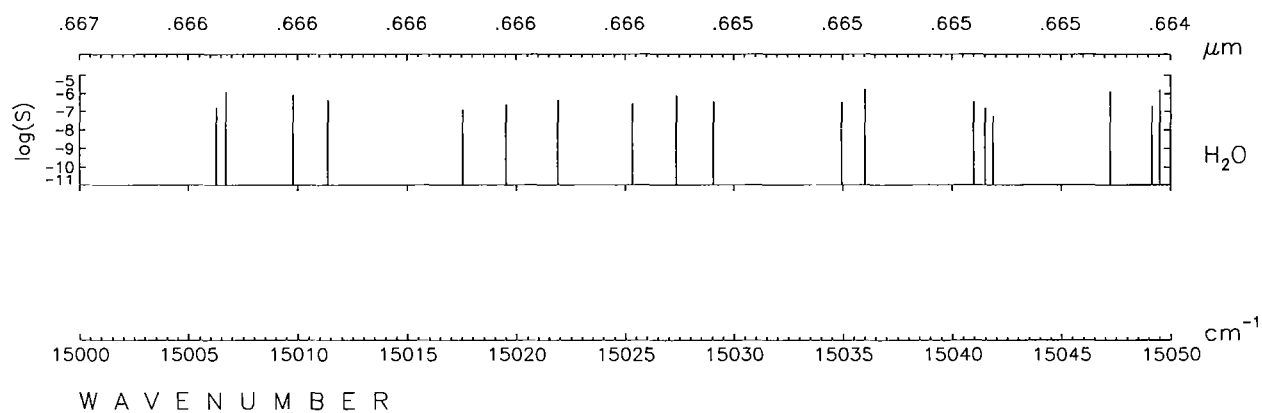
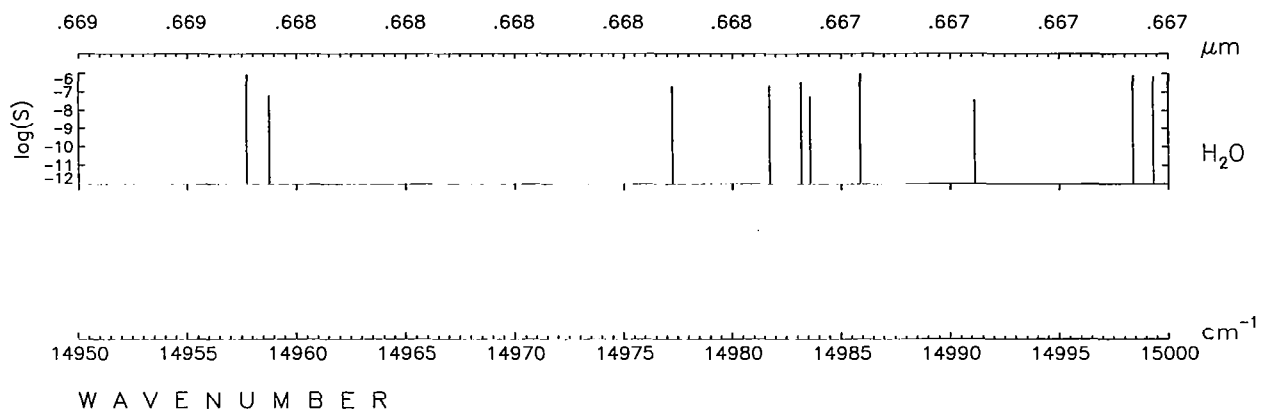


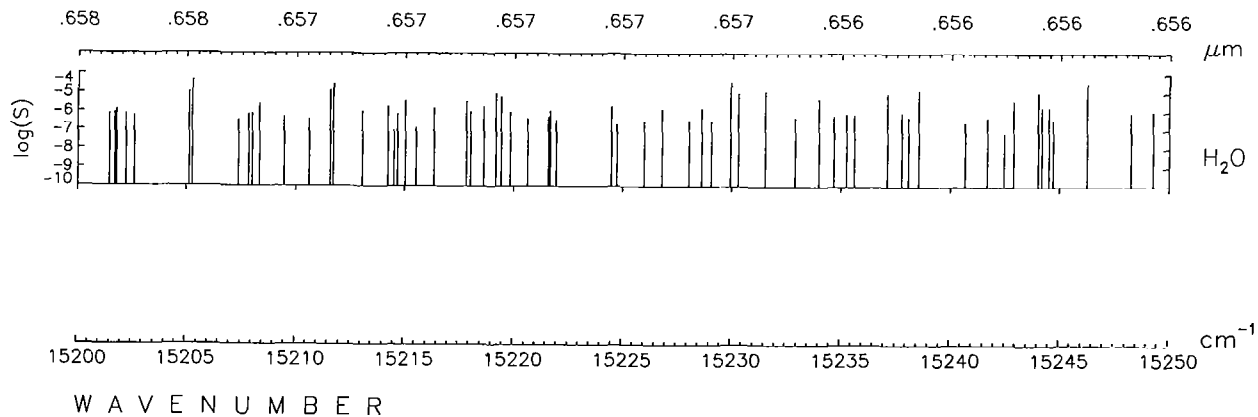
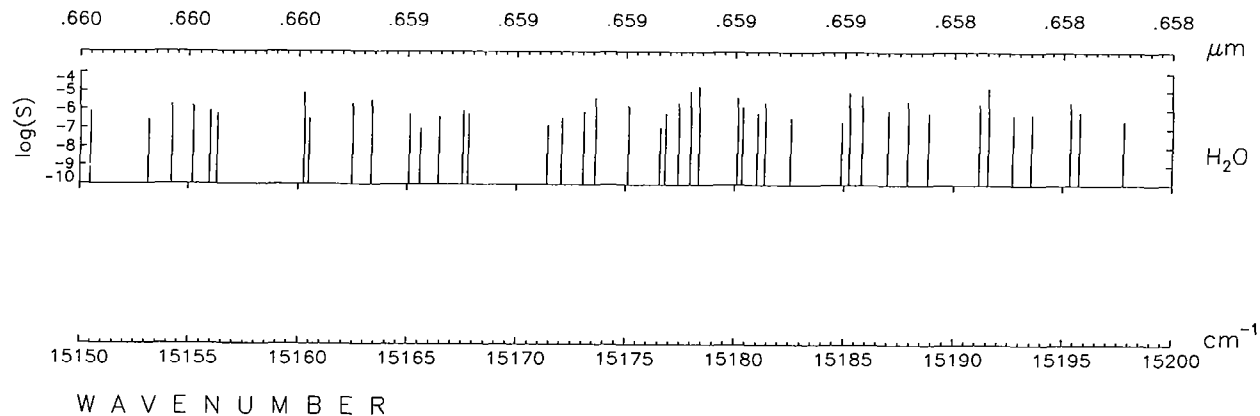
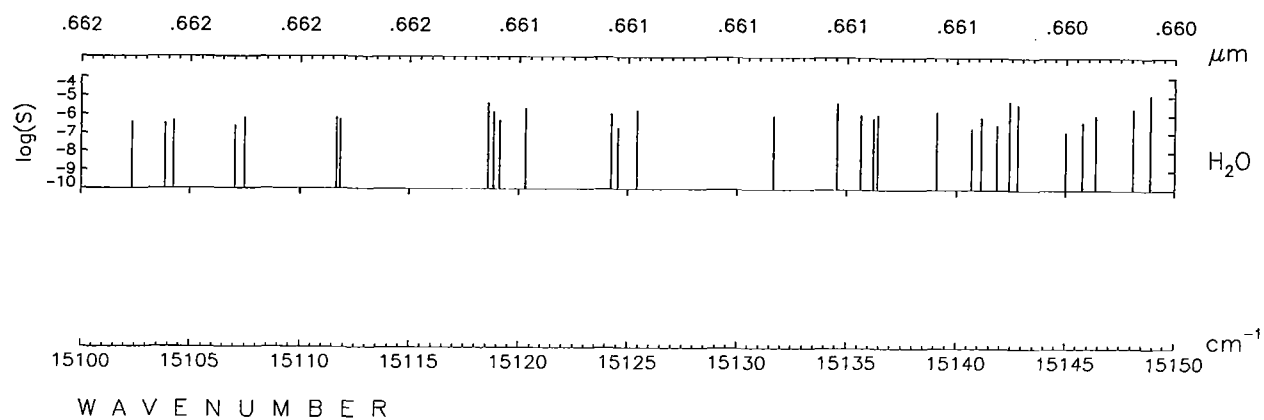


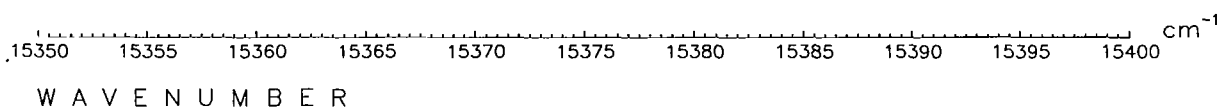
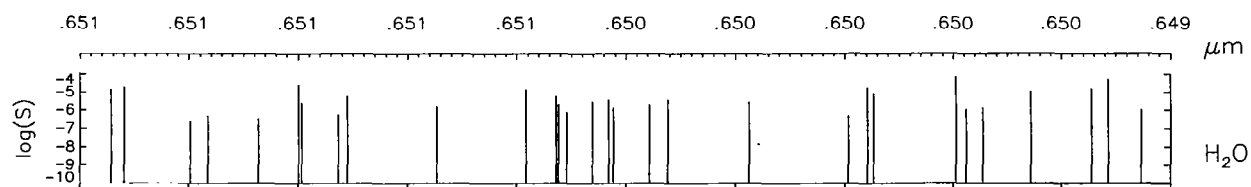
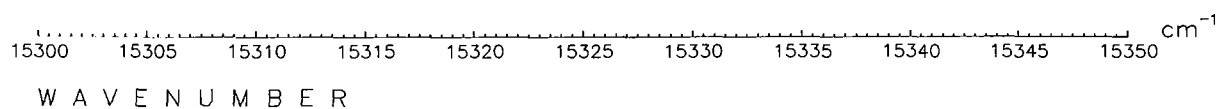
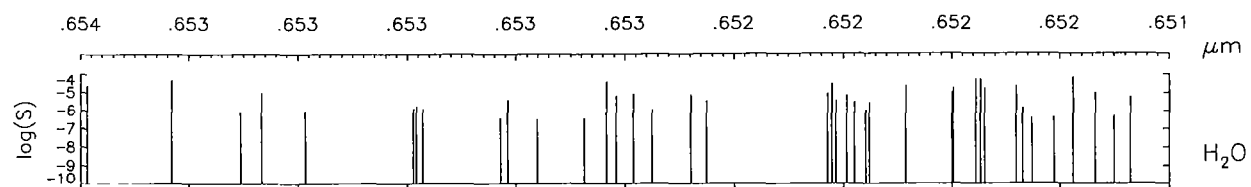
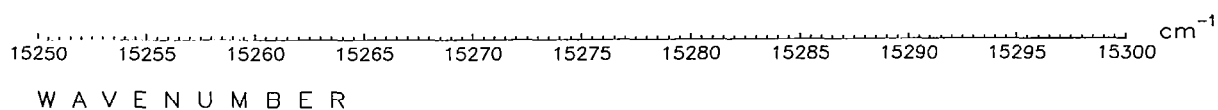
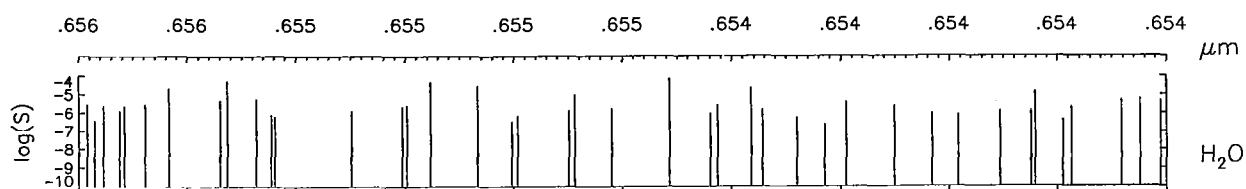


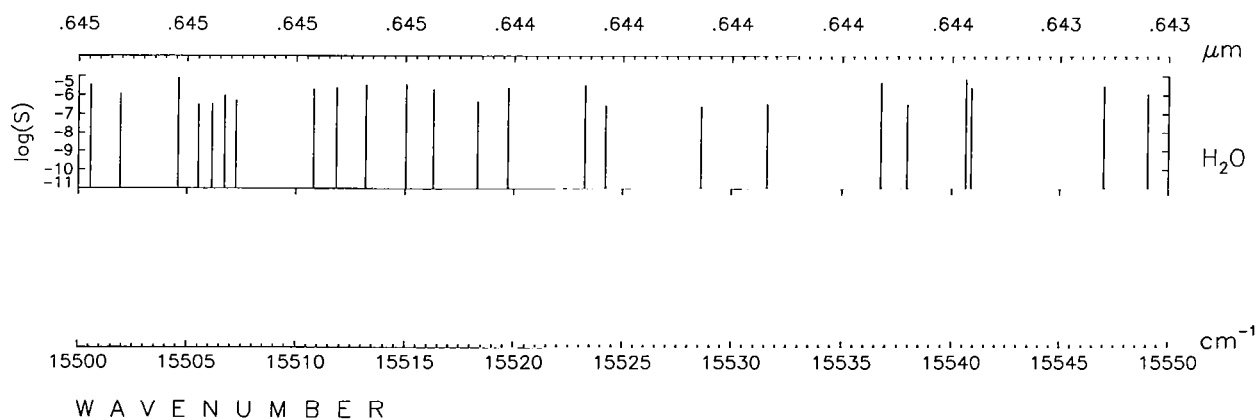
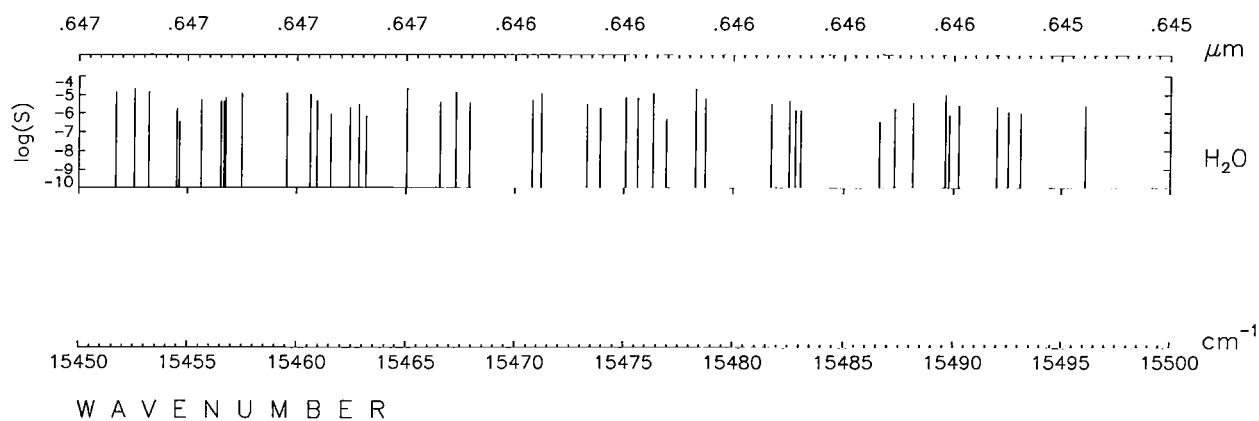
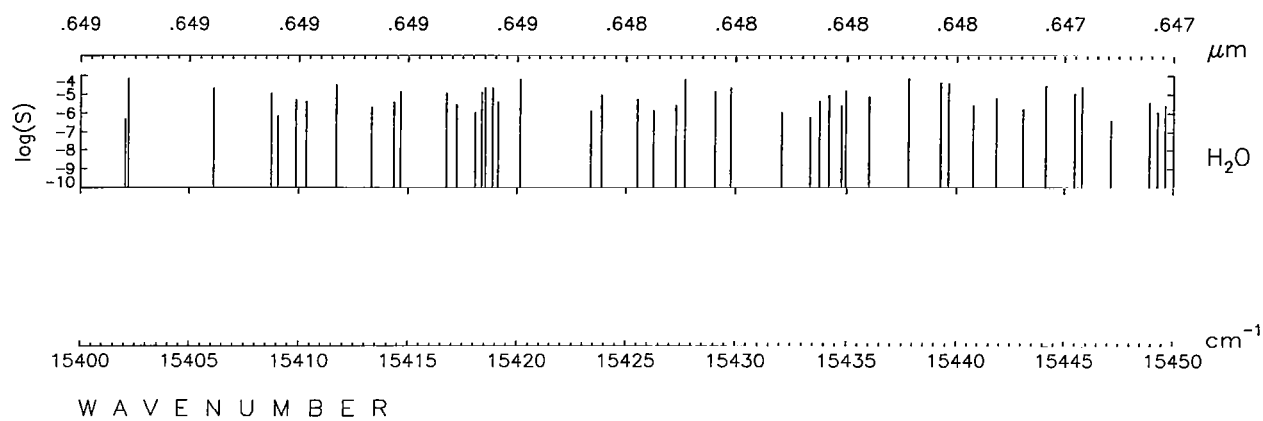


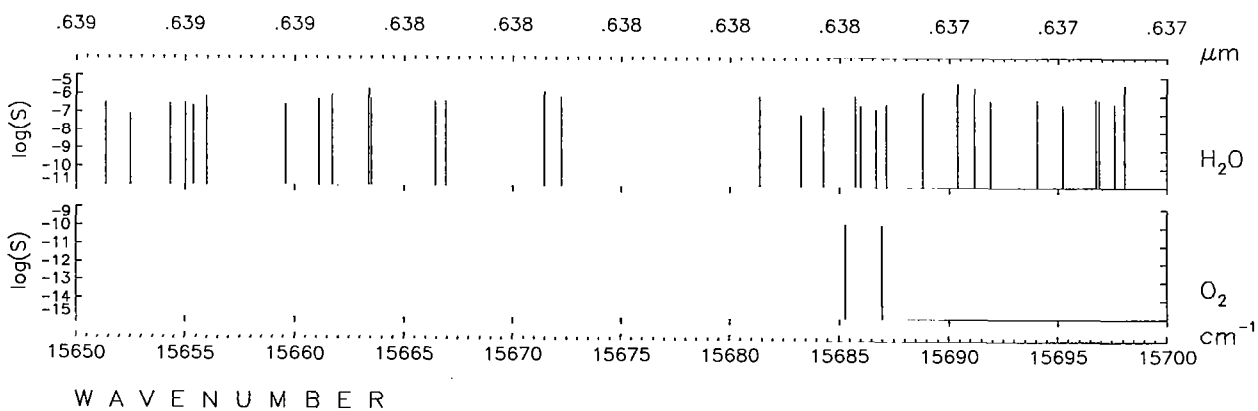
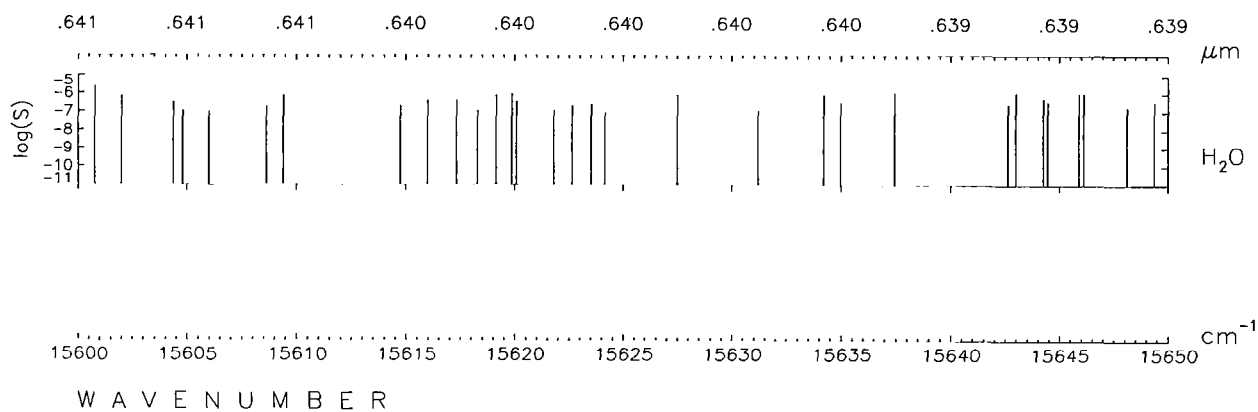
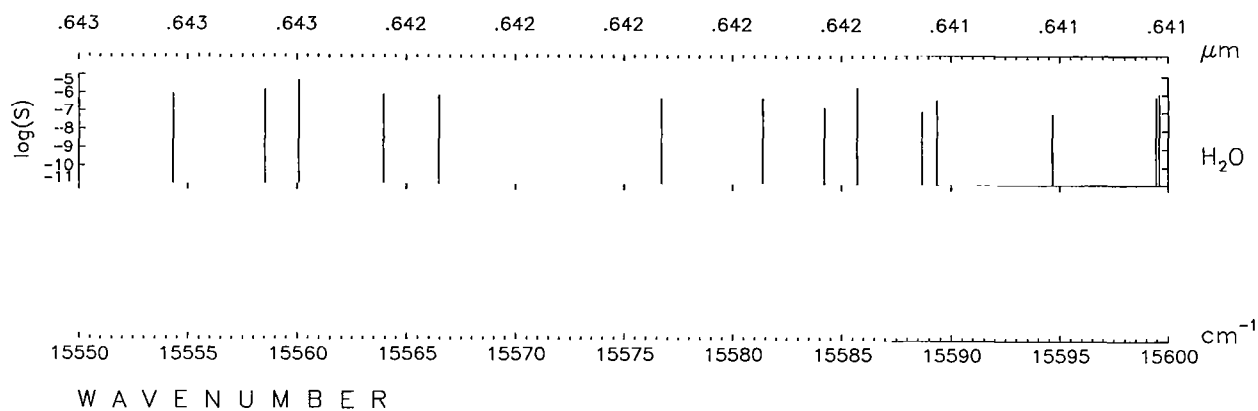


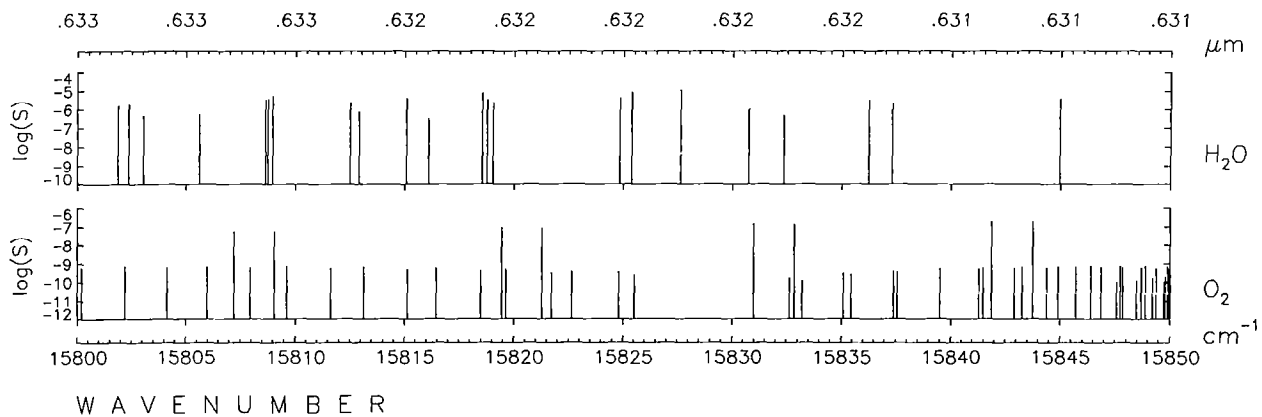
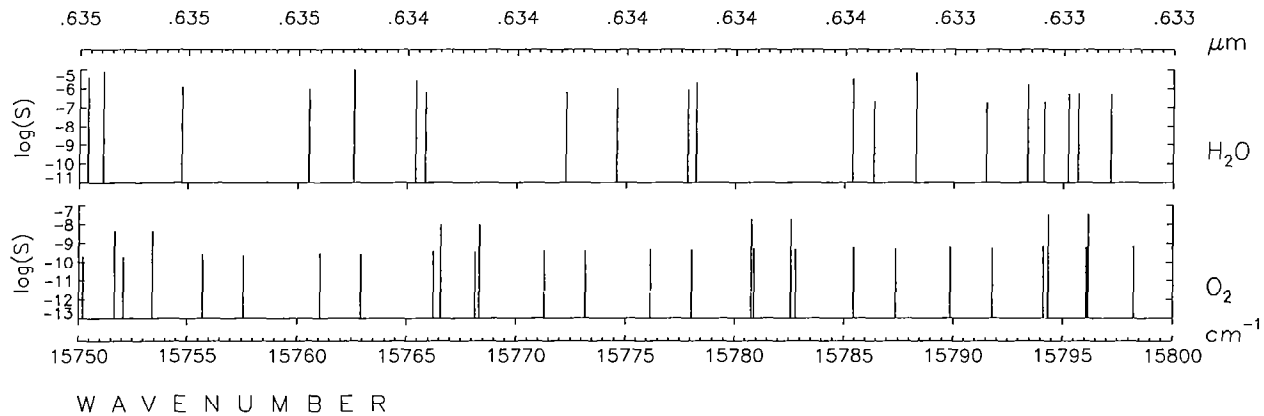
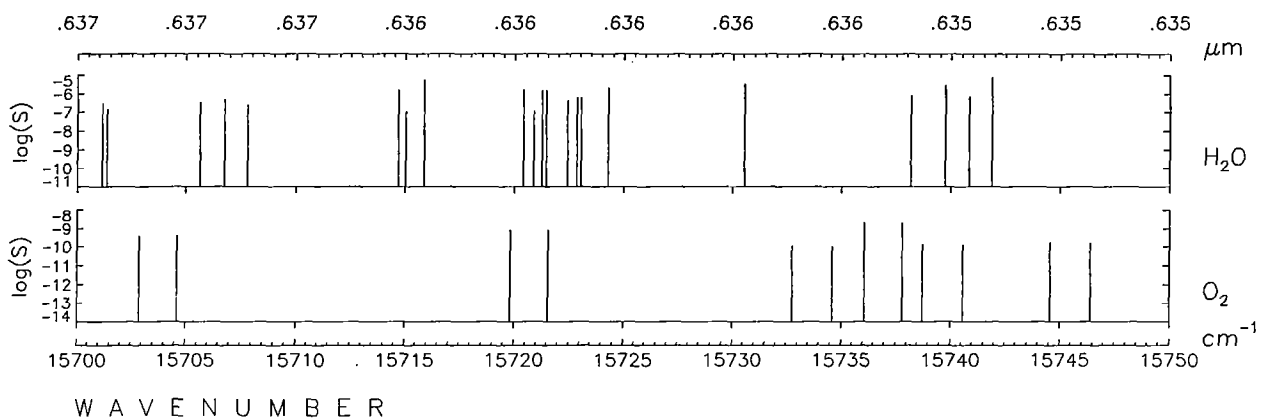


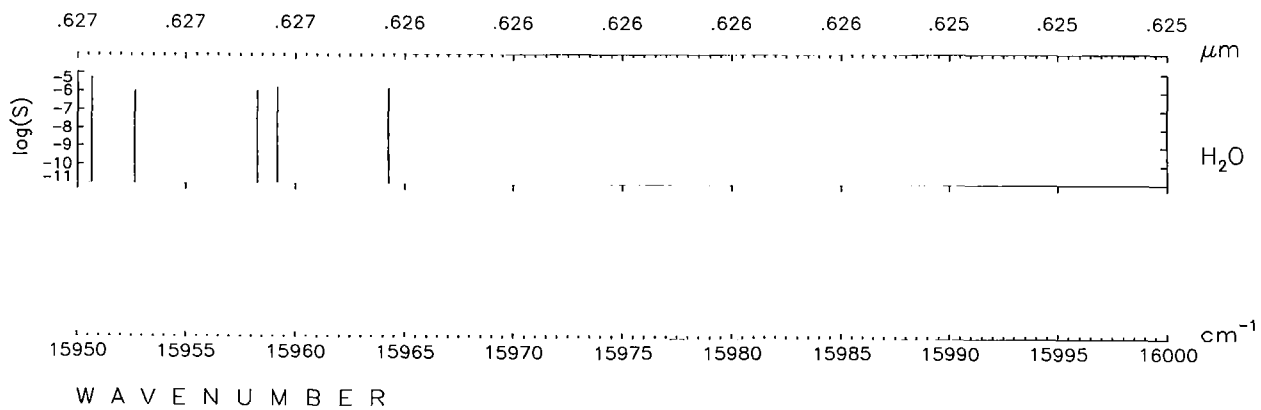
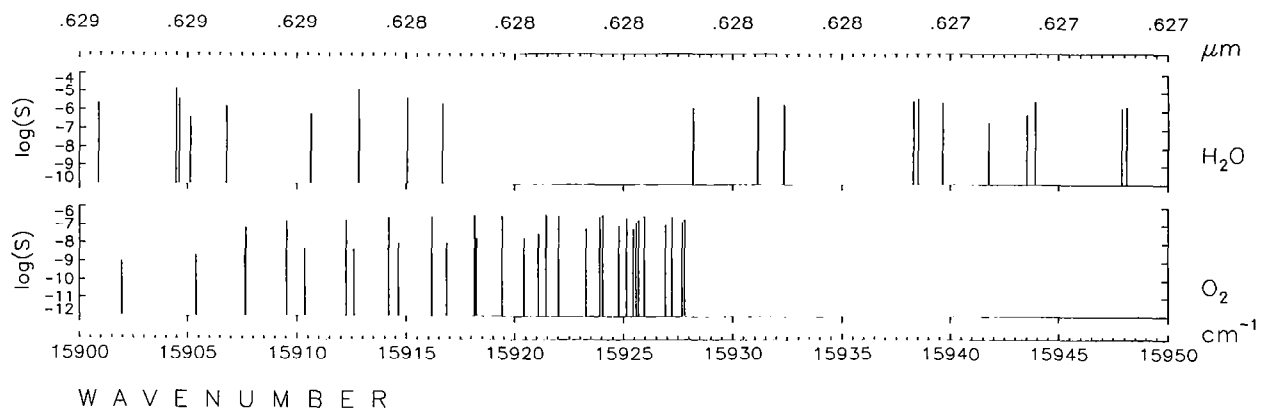
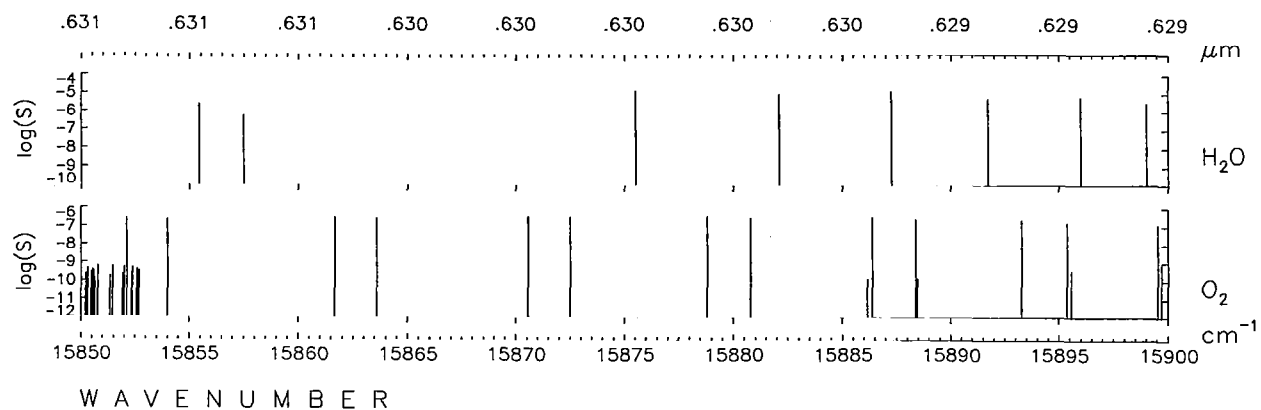














.625 .625 .625 .624 .624 .624 .624 .624 .623 .623 .623

16000 16005 16010 16015 16020 16025 16030 16035 16040 16045 16050  $\text{cm}^{-1}$   
W A V E N U M B E R

.623 .623 .623 .622 .622 .622 .622 .622 .622 .621 .621

16050 16055 16060 16065 16070 16075 16080 16085 16090 16095 16100  $\text{cm}^{-1}$   
W A V E N U M B E R

.621 .621 .621 .621 .620 .620 .620 .620 .620 .619 .619

16100 16105 16110 16115 16120 16125 16130 16135 16140 16145 16150  $\text{cm}^{-1}$   
W A V E N U M B E R

.619 .619 .619 .619 .618 .618 .618 .618 .618 .617 .617

16150 16155 16160 16165 16170 16175 16180 16185 16190 16195 16200  $\text{cm}^{-1}$   
W A V E N U M B E R


.617 .617 .617 .617 .617 .616 .616 .616 .616 .616 .615

16200 16205 16210 16215 16220 16225 16230 16235 16240 16245 16250  $\text{cm}^{-1}$   
W A V E N U M B E R

.615 .615 .615 .615 .615 .614 .614 .614 .614 .614 .613


16250 16255 16260 16265 16270 16275 16280 16285 16290 16295 16300  $\text{cm}^{-1}$   
W A V E N U M B E R

.613 .613 .613 .613 .613 .613 .612 .612 .612 .612 .612



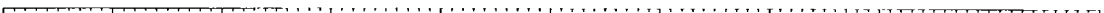
16300 16305 16310 16315 16320 16325 16330 16335 16340 16345 16350  $\text{cm}^{-1}$   
W A V E N U M B E R

.612 .611 .611 .611 .611 .611 .611 .610 .610 .610 .610

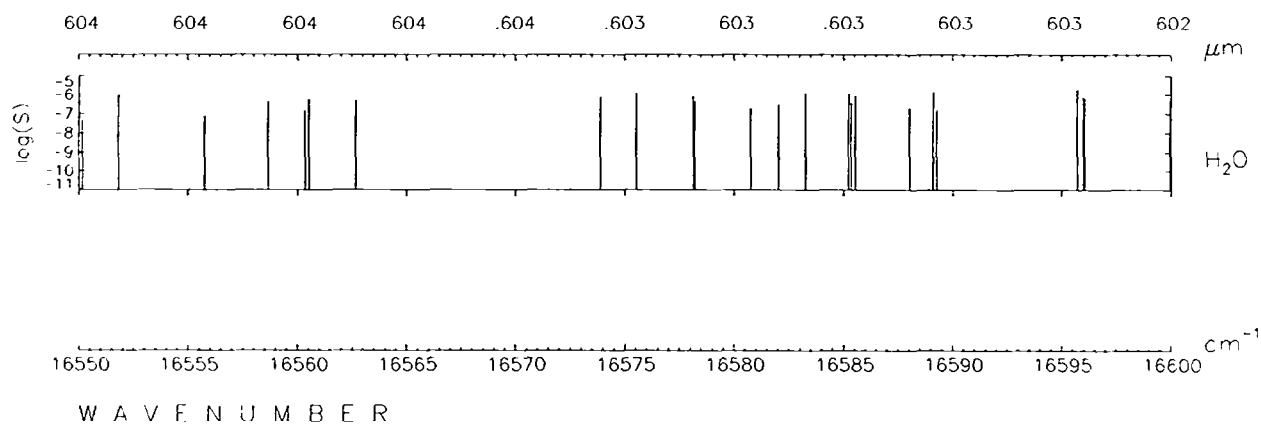
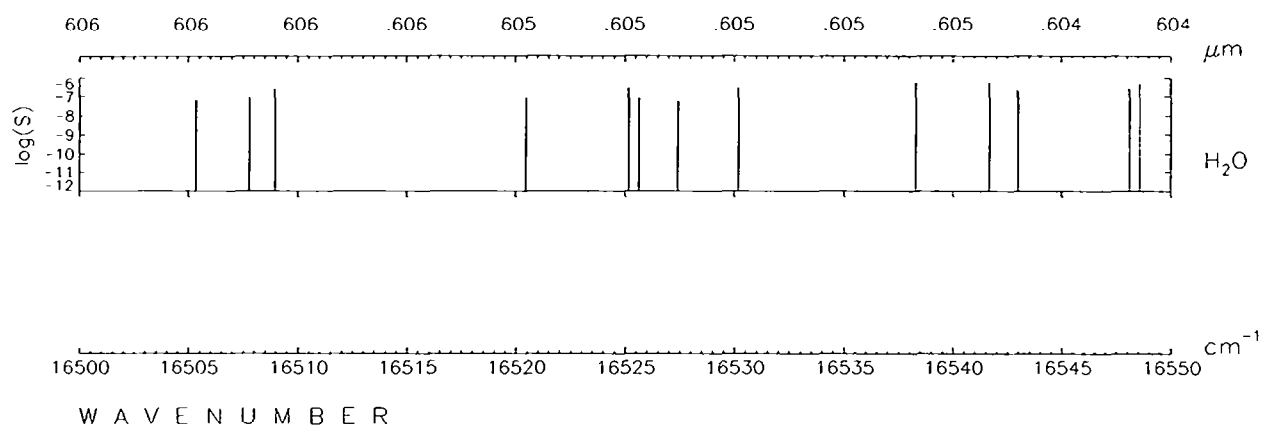
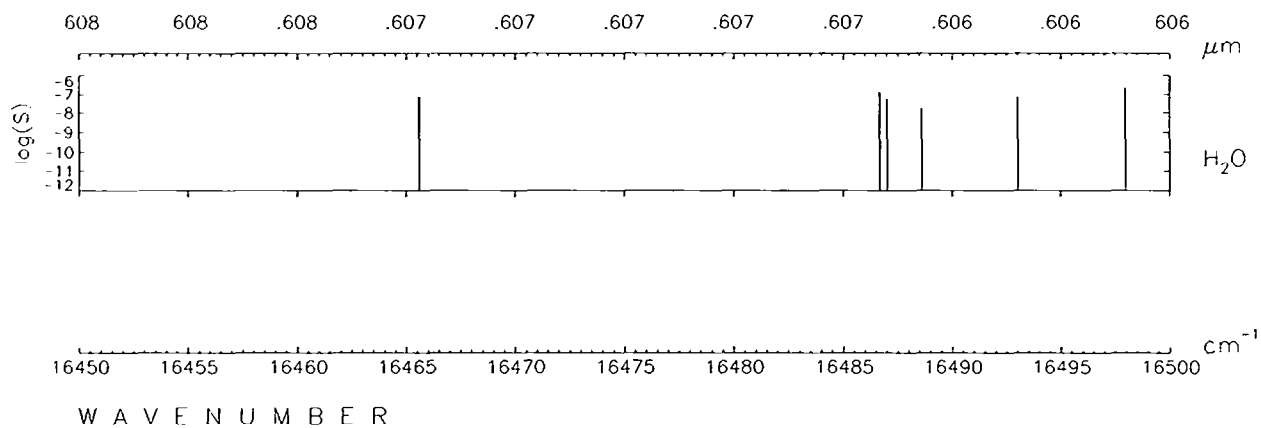


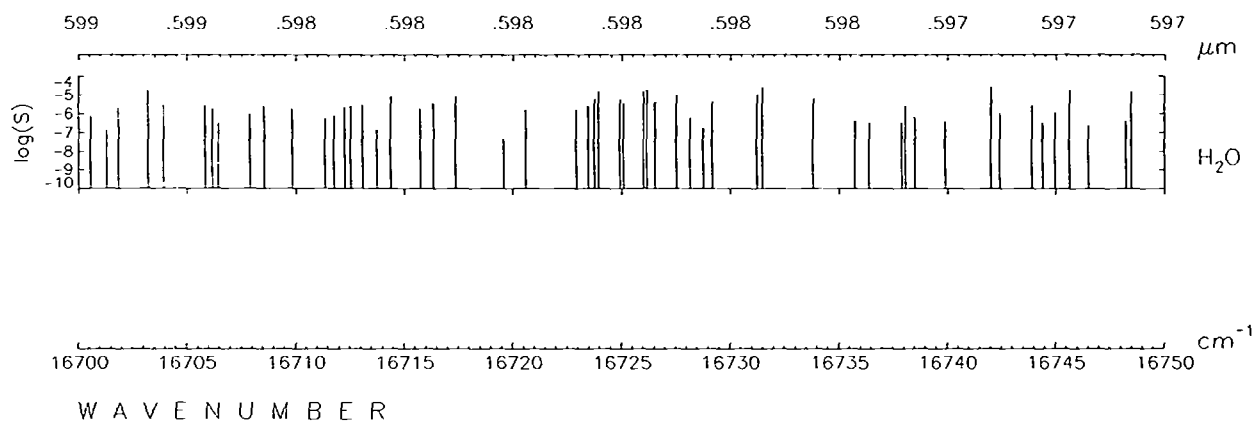
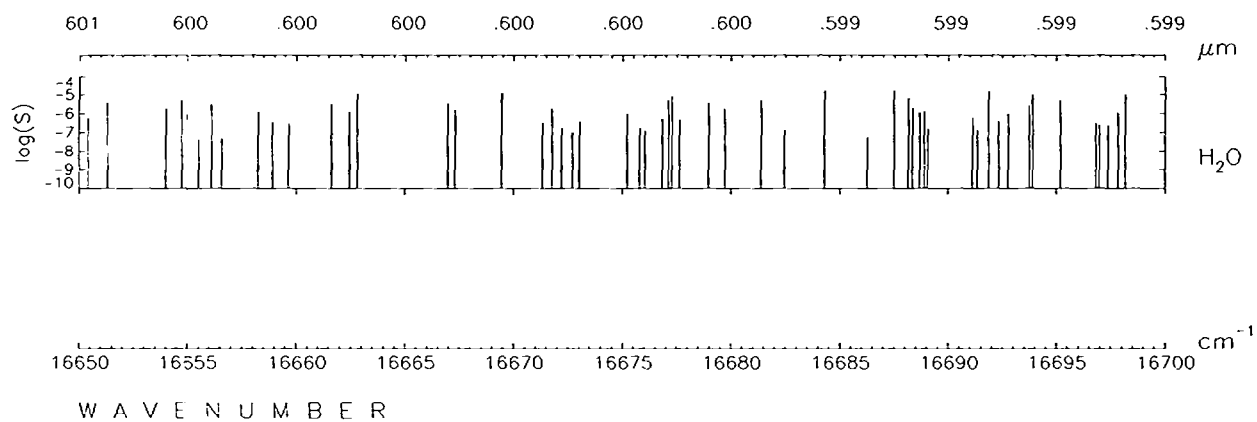
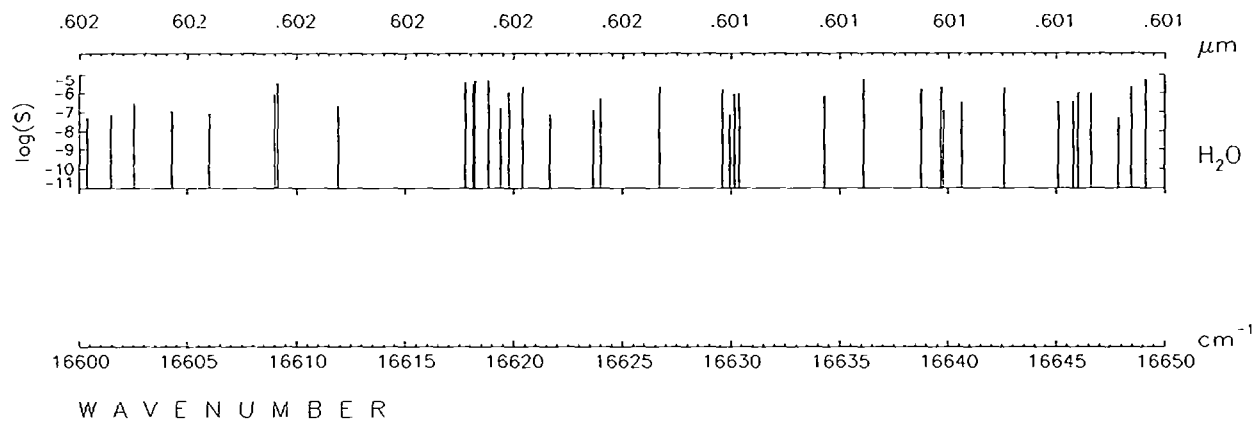
16350 16355 16360 16365 16370 16375 16380 16385 16390 16395 16400  $\text{cm}^{-1}$   
W A V E N U M B E R

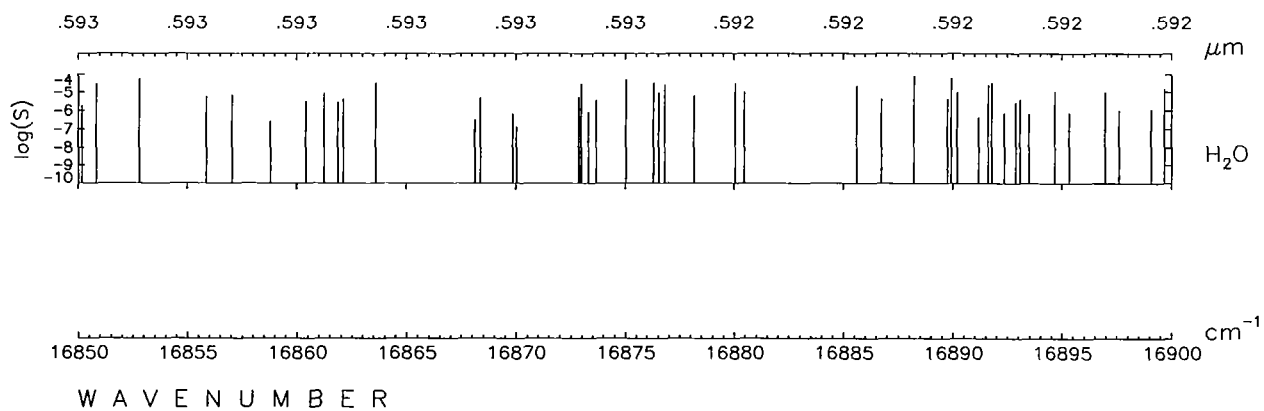
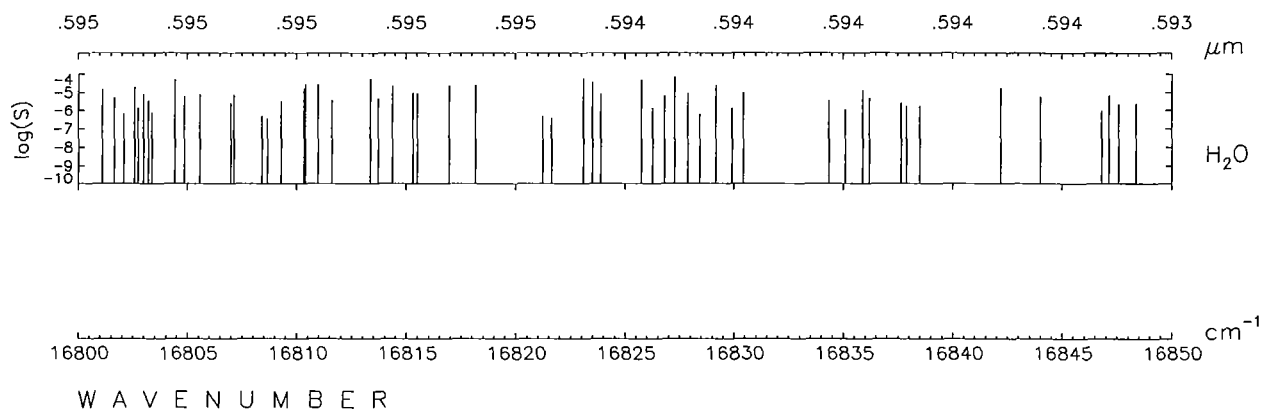
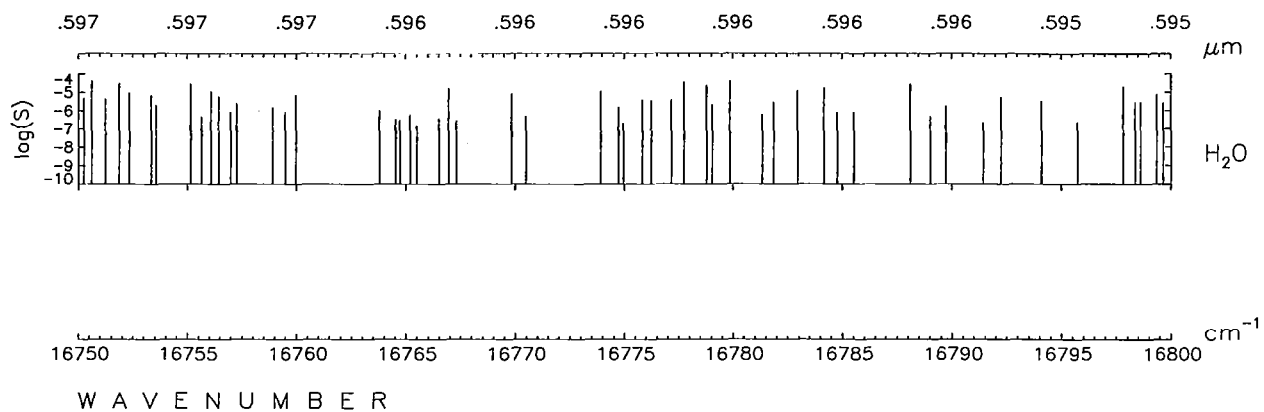
.610 .610 .609 .609 .609 .609 .609 .608 .608 .608 .608

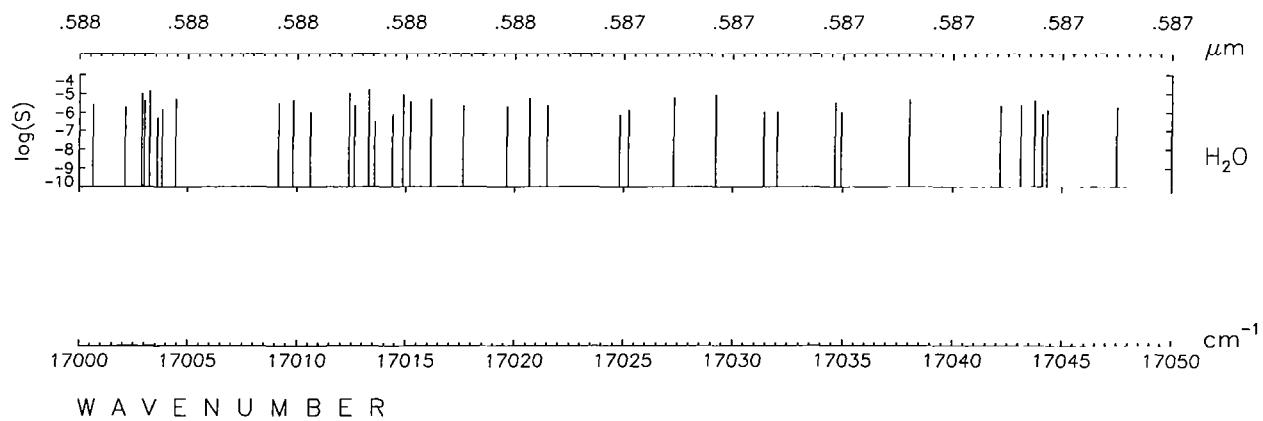
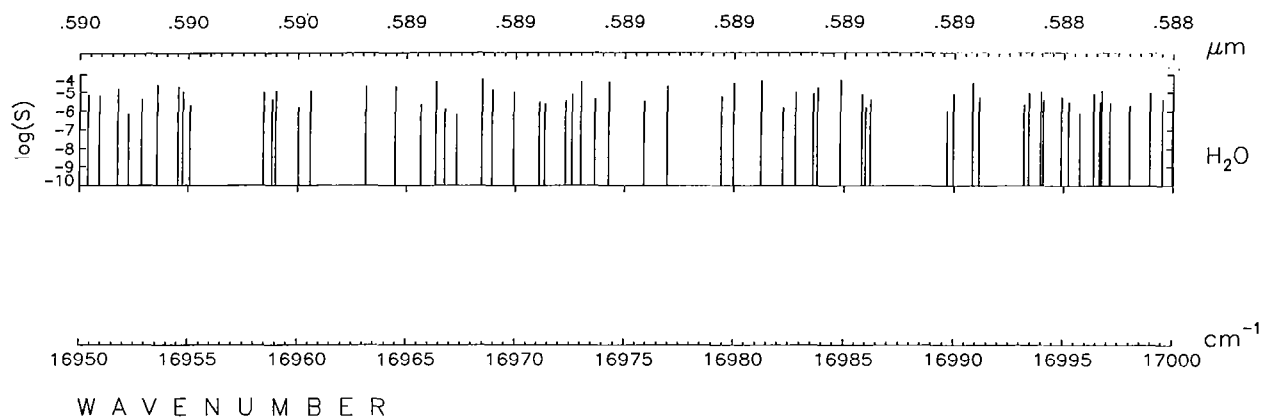
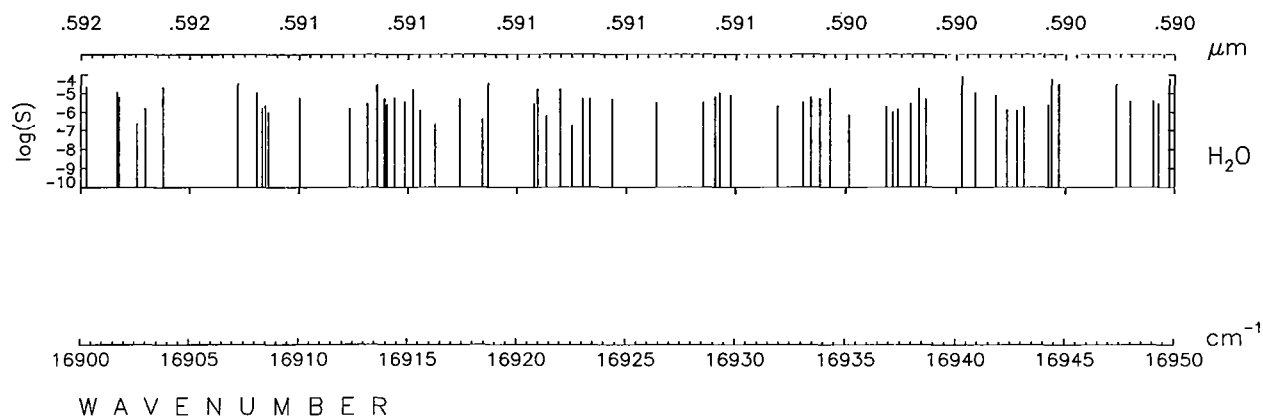


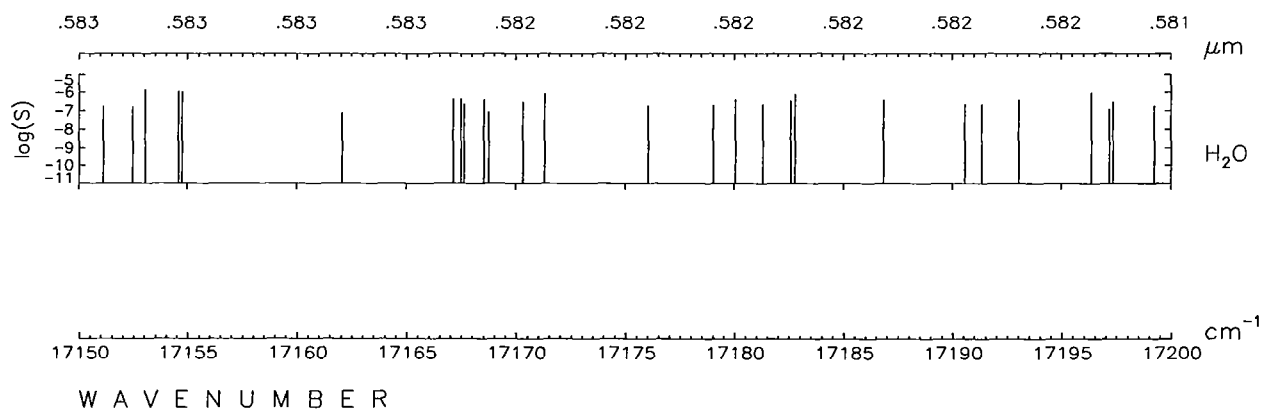
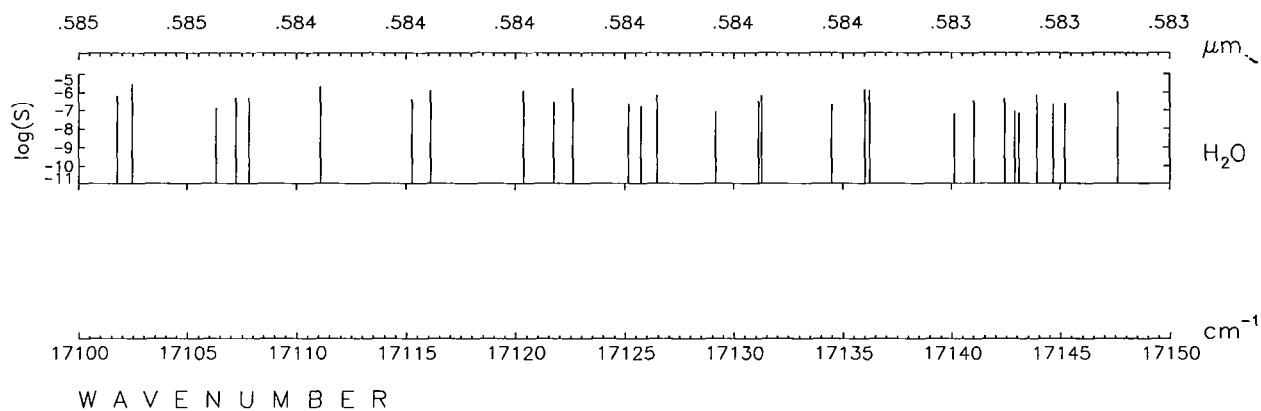
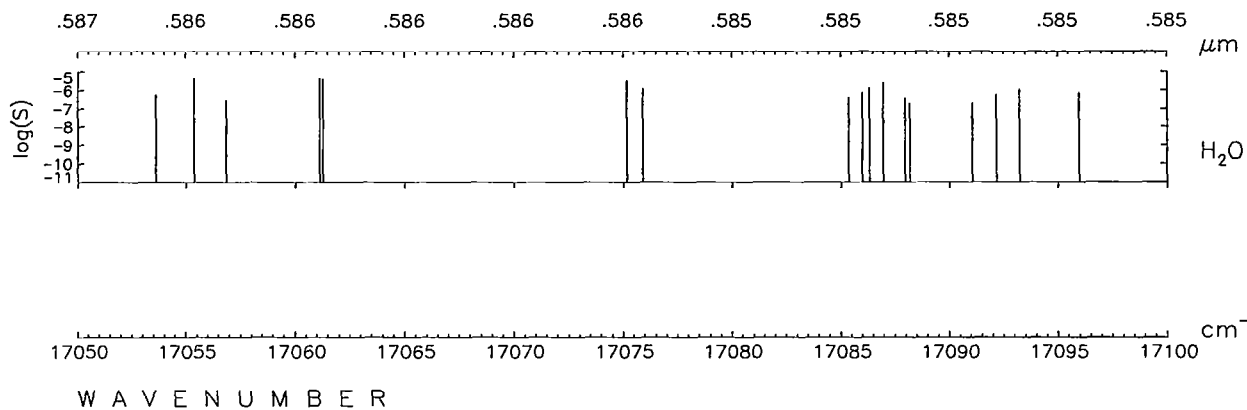
16400 16405 16410 16415 16420 16425 16430 16435 16440 16445 16450  $\text{cm}^{-1}$   
W A V E N U M B E R



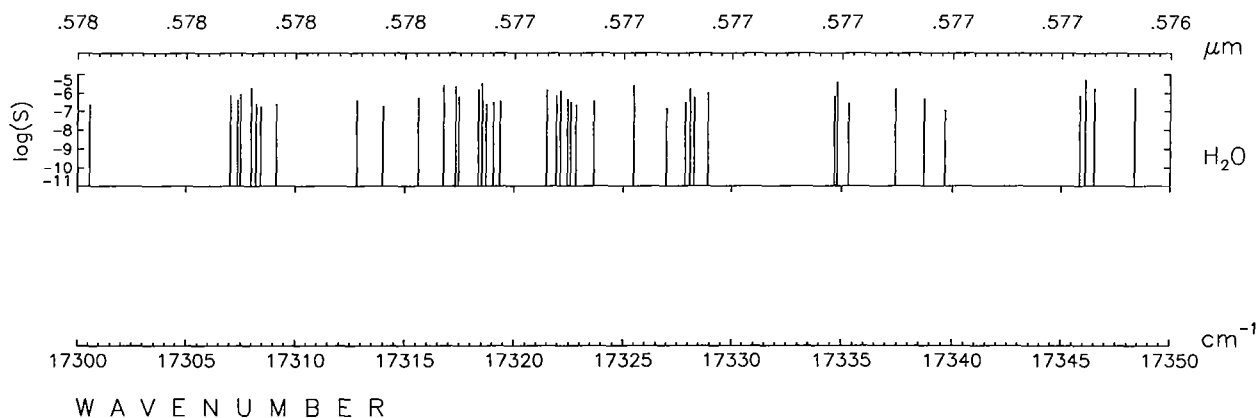
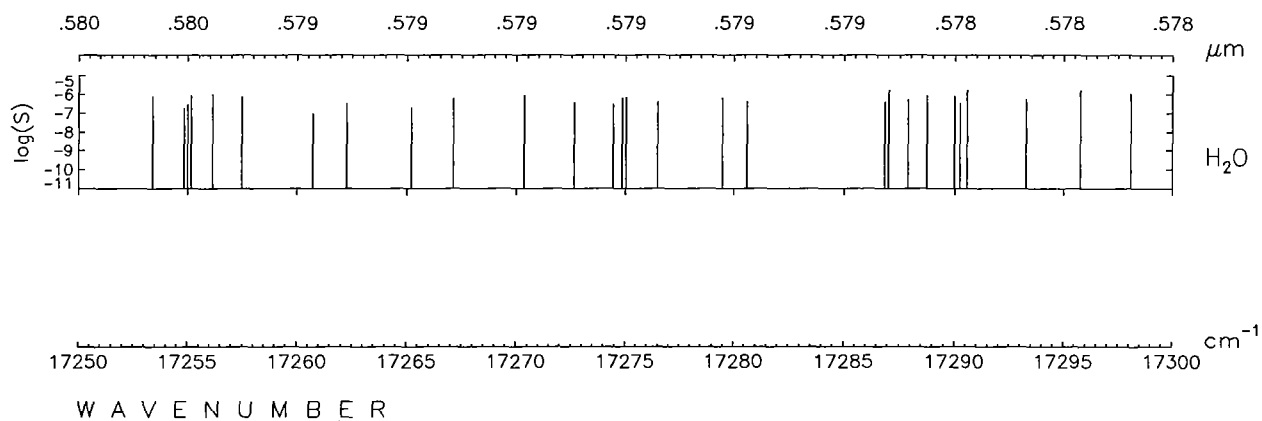
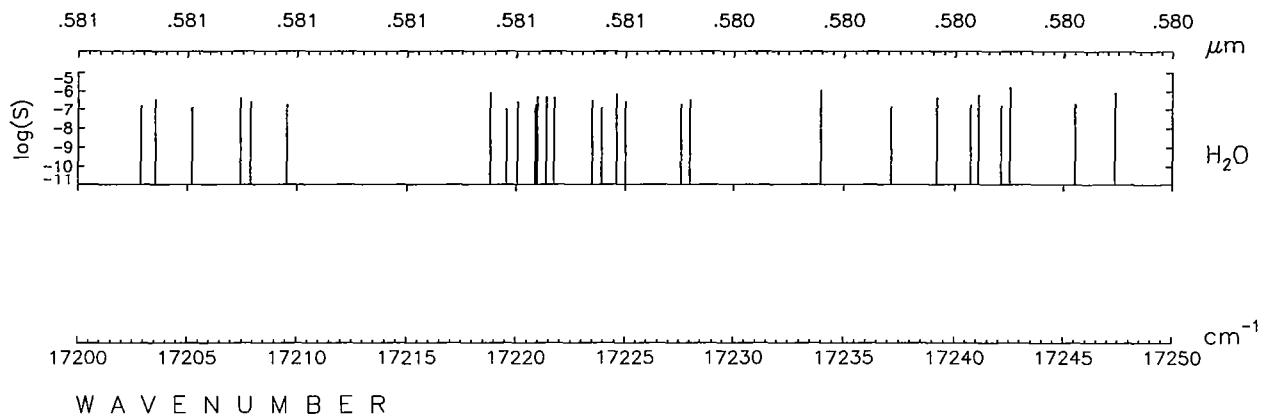


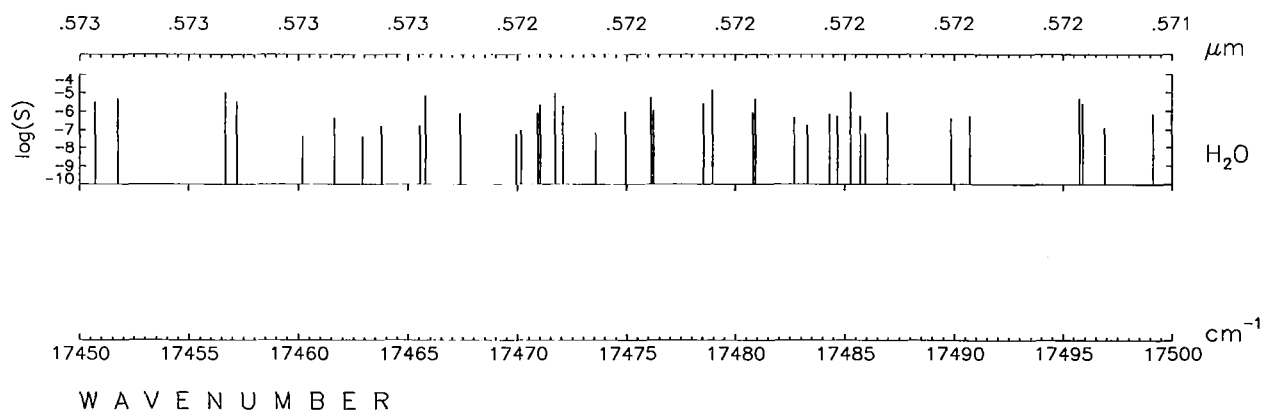
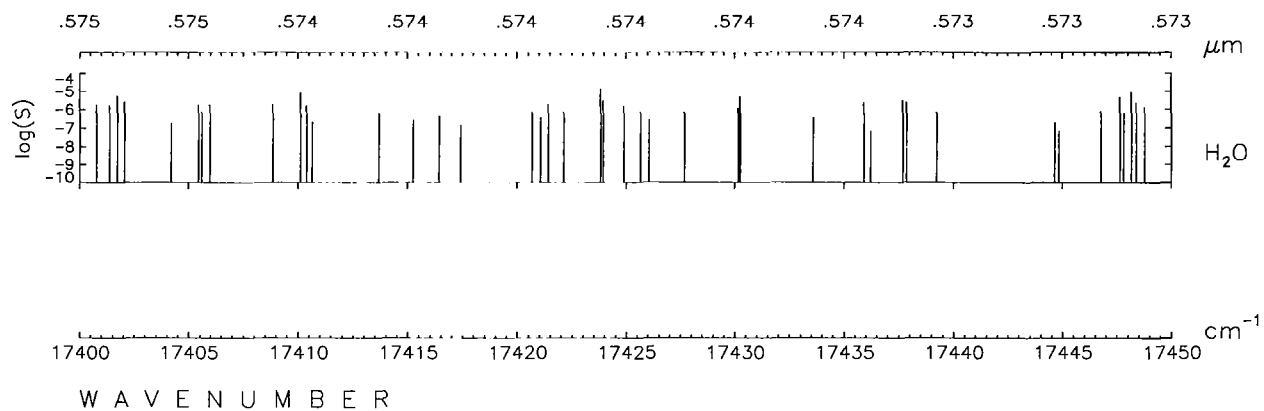
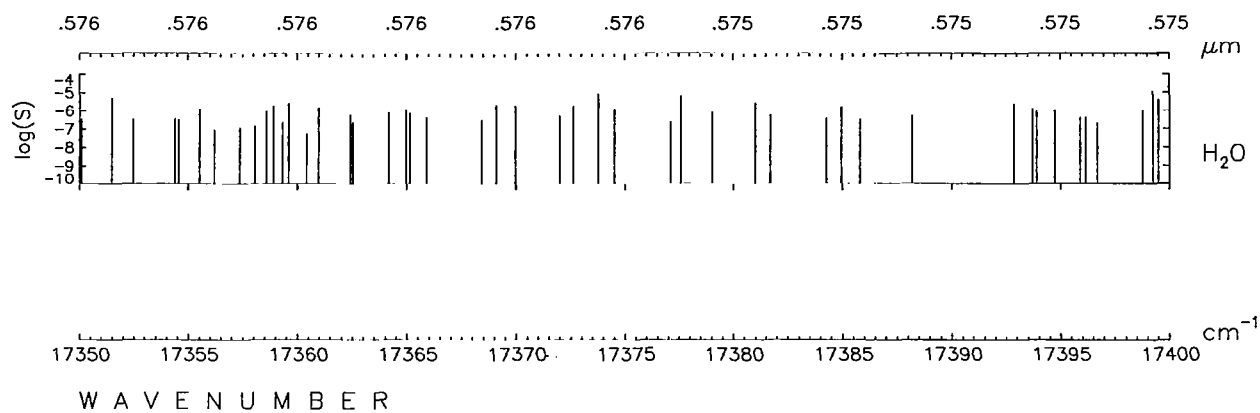


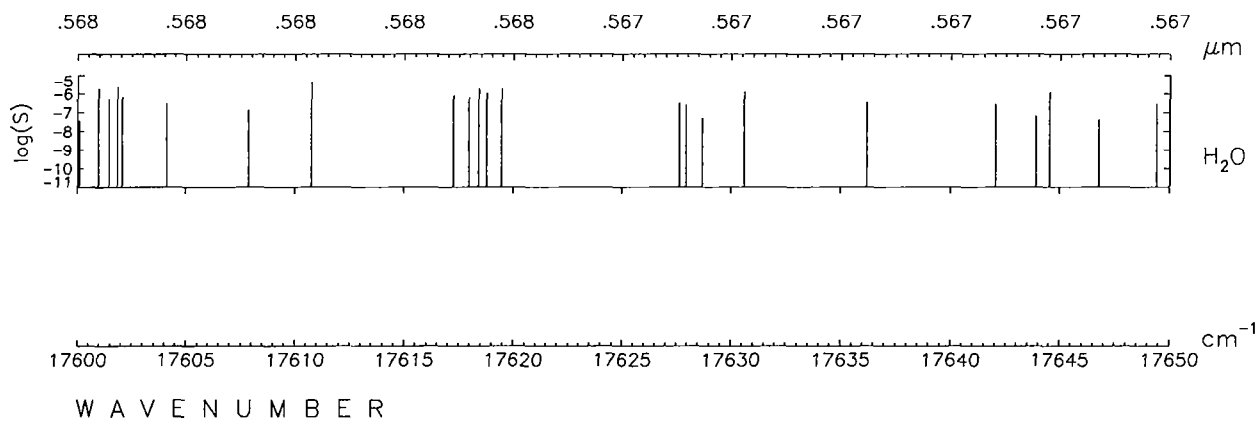
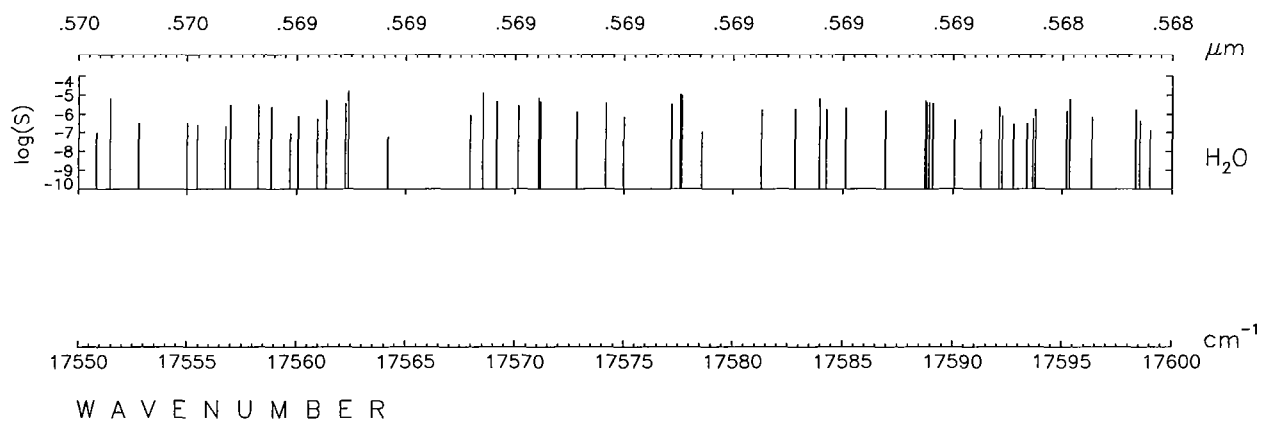
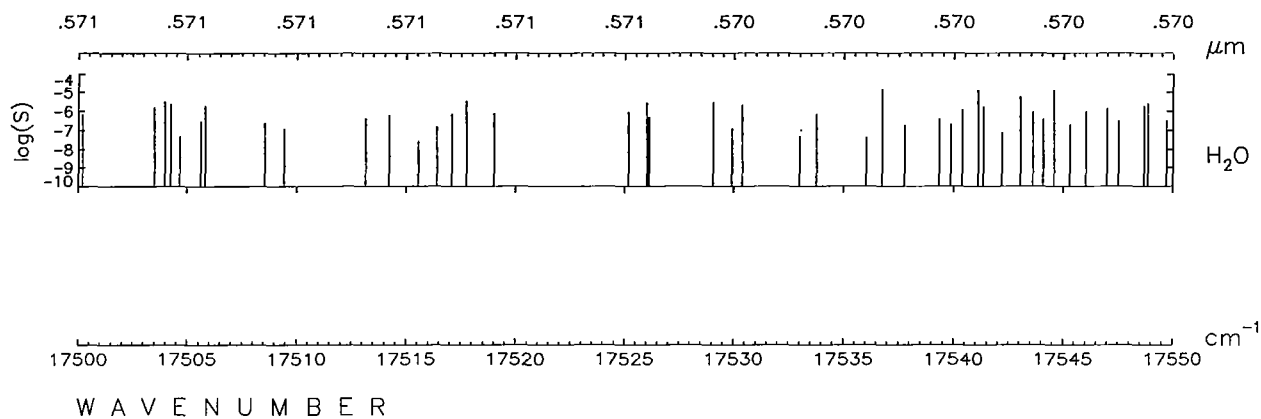


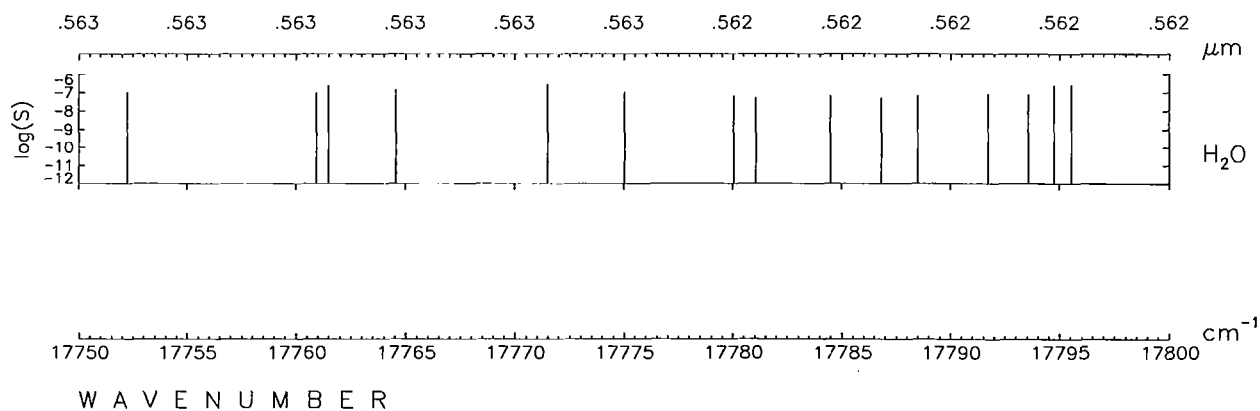
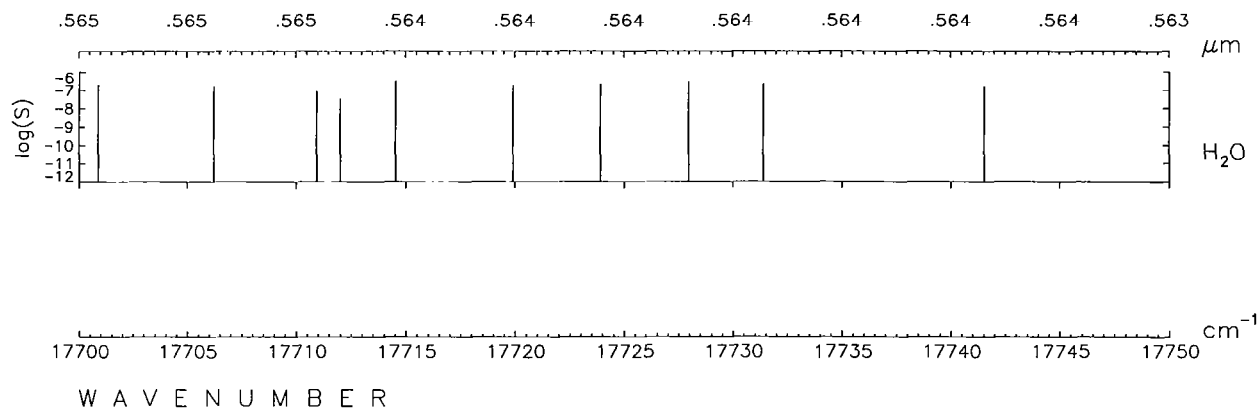
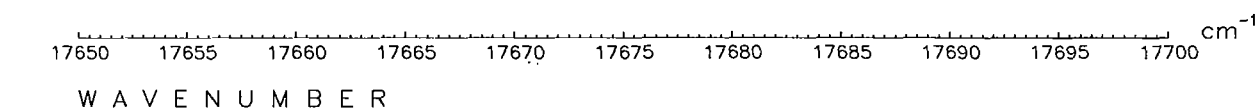
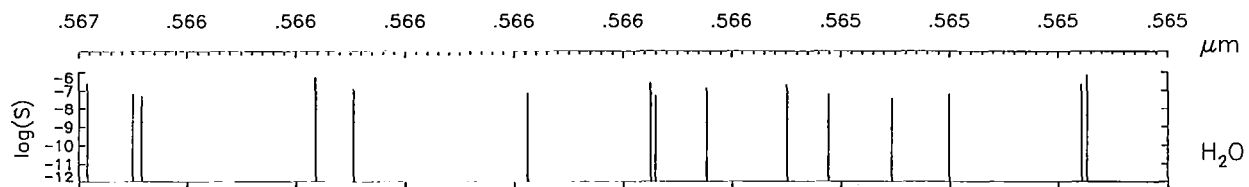


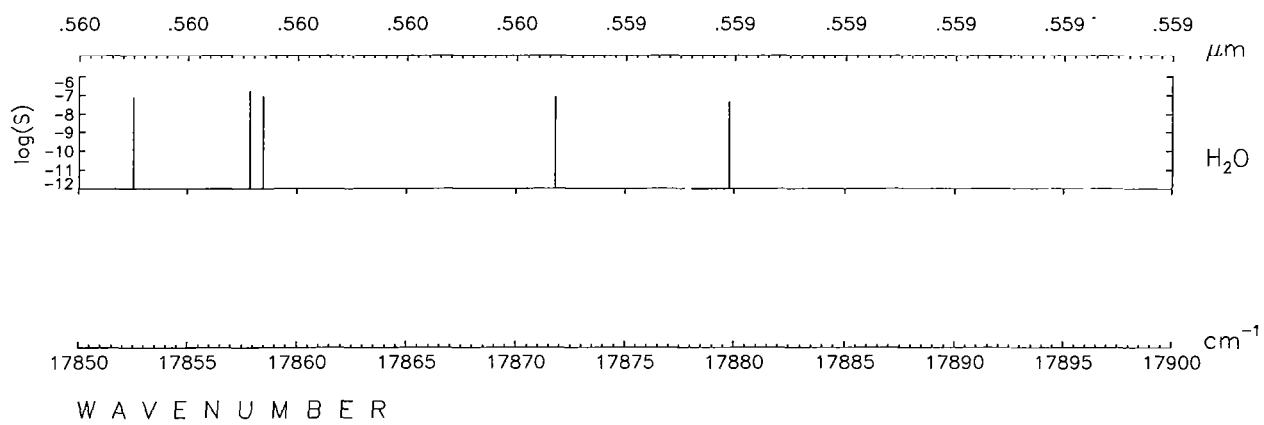
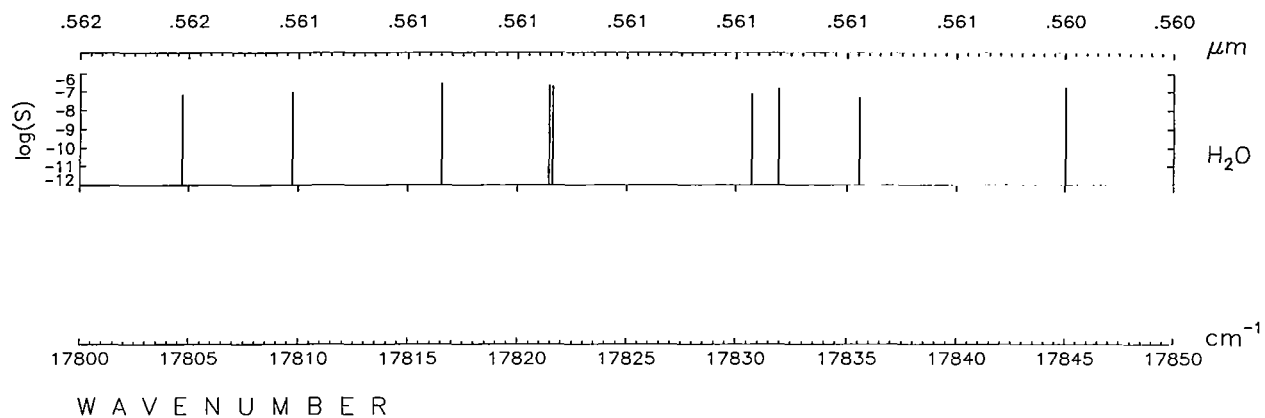












1. Report No. NASA RP-1084		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle  ATLAS OF ABSORPTION LINES FROM 0 TO 17 900 $\text{cm}^{-1}$				5. Report Date December 1981	
				6. Performing Organization Code 620-14-00-01	
7. Author(s) Jae H. Park, L. S. Rothman, C. P. Rinsland, M. A. H. Smith, D. J. Richardson, and J. C. Larsen				8. Performing Organization Report No. L-14720	
9. Performing Organization Name and Address  NASA Langley Research Center Hampton, VA 23665				10. Work Unit No.	
				11. Contract or Grant No.	
12. Sponsoring Agency Name and Address  National Aeronautics and Space Administration Washington, DC 20546				13. Type of Report and Period Covered Reference Publication	
				14. Sponsoring Agency Code	
15. Supplementary Notes  Jae H. Park and M. A. H. Smith: Langley Research Center. L. S. Rothman: Air Force Geophysics Lab., Hanscom AFB, Massachusetts. C. P. Rinsland: The College of William and Mary, Williamsburg, Virginia. D. J. Richardson and J. C. Larsen: Systems and Applied Sciences Corp., Hampton, Virginia.					
16. Abstract  Plots of absorption line strength versus line position for wavenumbers from 0 to 17 900 $\text{cm}^{-1}$ are shown for the 20 atmospheric gases ( $\text{H}_2\text{O}$ , $\text{CO}_2$ , $\text{O}_3$ , $\text{N}_2\text{O}$ , $\text{CO}$ , $\text{CH}_4$ , $\text{O}_2$ , $\text{NO}$ , $\text{SO}_2$ , $\text{NO}_2$ , $\text{NH}_3$ , $\text{HNO}_3$ , $\text{OH}$ , $\text{HF}$ , $\text{HCl}$ , $\text{HBr}$ , $\text{HI}$ , $\text{ClO}$ , $\text{OCS}$ , $\text{H}_2\text{CO}$ ), which appear in the 1980 Air Force Geophysics Laboratory major-gas and trace-gas compilations, and for $\text{N}_2$ and $\text{CH}_3\text{Cl}$ at 296 K and solar $\text{CO}$ at 6000 K. Also shown are similar plots of lower-state energy values for absorption lines for the strongly absorbing atmospheric gases ( $\text{H}_2\text{O}$ , $\text{CO}_2$ , $\text{O}_3$ , and $\text{CH}_4$ ) for wavenumbers from 0 to 5000 $\text{cm}^{-1}$ .					
17. Key Words (Suggested by Author(s))  Spectroscopy   Remote sensing Infrared        Pollution Microwave Absorption Emission			18. Distribution Statement  Unclassified - Unlimited   Subject Category 72		
19. Security Classif. (of this report)  Unclassified	20. Security Classif. (of this page)  Unclassified	21. No. of Pages  207	22. Price  A10		